

Björn E. W. Nordenström, M.D.

Exploring BCEC-Systems

(Biologically Closed Electric Circuits)

Nordic Medical Publications

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Foreword

When I read Dr. Björn Nordenström's first book *Biologically Closed Electric Circuits* (BCEC) I did not understand it. I believed in his basic premise, that the human body has an additional electrical circulatory system. This system involves the co-transport of ions and electrons that form continuous electric currents in various portions of the body. But I had a difficult time reading and understanding his first book. I read it over and over again, and I still had difficulties getting "the message". I thought, "Maybe this material is just too complex for me."

Then, it all came together in a flash. In a moment of inspiration I realized that my problems with understanding his book was not because it contained complex material. The real reason that I was having difficulty understanding Dr. Nordenström's message was because - - - his message is simple - - - the theory behind it is simple. My preconceived notions were the source of the complexity that I had imagined. All I had to do was toss out a few preconceived notions, ignore some of my previous training in biomedical sciences and use a conceptual model that is not much more complicated than the electrical circuits involved with an automobile battery. Dr. Nordenström has a unique talent of observing seemingly complex phenomena, questioning the meaning of the phenomena and describing the theory behind that phenomena in relatively simple terms.

Dr. Nordenström sees what others do not see or recognize as being significant. Next to him, I feel like a blind man. Where others see blips and artifacts on a cancer patients's radiograph, Dr. Nordenström sees movement of water and material. He sees (and measures) electric potentials between a tumor and healthy tissue. He, then, proposes a theory of *Biologically Closed Electric Circuits* (BCEC). From this theory, he develops electrotherapeutic techniques to treat cancer and other diseases. His theories are "put to the test", and they pass with flying colors.

Some will look at a colored region on a gel that has been electrically excited. Most will view the colored region as a blot of color. Dr. Nordenström sees spiralling vortices of charged matter. Some people look into the vastness of space and see it as "empty space". Dr. Nordenström looks at

the vastness of space and sees it as being full of lifegiving energy. He views space as a vessel storing the energy resources that serve as the foundation for all living things.

Björn Nordenström has the mind of a medical doctor, scientist, engineer, poet, musician, philosopher and child who keeps asking; "Why?" He often tempers his judgements with the realization that "nothing is as it seems". "We must rigorously test our theories." Dr. Nordenström is a man with many questions, who is not chained by dogma. If the dogma is clearly wrong, outdated or does not make sense; Dr. Nordenström has the brilliance and courage to change that dogma or develop a new one. In doing so, he irritates those who are chained by their dogma and preconceived notions. This is a man who can have an emotional and intellectual impact on all of us if we just let him "rattle our chains".

BCEC concepts and the electrotherapeutic techniques that are evolving from these concepts are extraordinary developments in the history of medicine. Many biomedical researchers have expressed the opinion that "If Dr. Nordenström is wrong, his work and results still provide significant motivation for us to look at biological systems in a different way." "However, if Dr. Nordenström is right, he will have made the most significant discovery and contribution to medicine since William Harvey described blood circulation more than 350 years ago."

There are many similarities between the research effort, approach and initial reactions to the work done by William Harvey and Björn Nordenström. Using what was known about physiology, mathematics and physics in his time; Harvey's experiments demonstrated that blood circulated at an unbelievably high velocity. Blood did not just "ebb and flow" as the dogma of the time maintained. Many of Harvey's colleagues demonstrated a Stage 1 medical reaction (instant rejection coupled with anger and ridicule). But the concepts Harvey developed had enough relevance in medicine that, over a long period of time, attitudes changed; and the Stage 2 medical reaction (reluctant acceptance) began to dominate medical thinking and practice.

In a similar manner, for the past 30 years, Björn Nordenström has utilized concepts in physics, mathematics, chemistry, physiology and immunology; combined with a massive amount of experimentation; to describe a system of continuous energy circulation and circulating electrical currents in living systems. Dr. Nordenström demonstrates how "circulating currents

influence structure and function. These currents participate in maintaining equilibrium and healing processes in living organisms.” Dr. Nordenström’s concepts of continuous energy circulation, the interrelationships between life and death; proliferation and regression, energy and matter and macroscopic and microscopic phenomena appear very clear to me.

Dr. Nordenström initially encountered a significant amount of the Stage 1 medical reaction from his colleagues. However, in a manner similar to William Harvey’s experience, Dr. Nordenström’s concepts work very well when they are applied to medical practice. Thousands of cancer patients have been successfully treated all over the world (Sweden, China, Germany, Italy, Denmark and Poland) with an electrochemical therapy (EchT) approach that was initially developed using BCEC concepts. It is just a matter of time before the Stage 2 medical reaction occurs with respect to Dr. Nordenström’s BCEC theories and the electrotherapeutic techniques derived from his BCEC concepts.

To appreciate Dr. Björn Nordenström, this is the book you need to read first. Once you have finished this book, I would recommend that you read the other one authored by Dr. Nordenström, *Biologically Closed Electric Circuits*. But before you read either book, open your mind and try to ignore your biases. Try to view the author as a brilliant, gentle, wise and knowledgeable renaissance man who is firm in his convictions. Some would say “stubborn”. (I think the word “firm” is more appropriate). Regard Björn Nordenström as a guide and good friend with a firm hand, who is going to take you on a very interesting adventure. The places he takes you may scare you a bit, but your guide and friend has a strong grip on your hand. He won’t let go. And when your journey is finished, you will have been given the privilege of viewing the next paradigm in biomedicine by the man who was the first to describe it in a way that it can be understood and applied.

George D. O’Clock, Ph.D., Professor
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May, 1998

Comments

The difficulties to recognize the BCEC-systems are clearly described by George O'Clock. His knowledge in electrophysics has made it possible for him to accept the BCEC as a physical principle. Yet, it must be far more difficult for medical doctors to understand that the flow of electricity requires closed circuits not only in "technology" but also in biology.

The first BCEC-identification was the Vascular-Interstitial-Closed Circuit (VICC) where closed circuit flow of ions produce 12 radiographically identified corona structures around cancers. This was a lucky coincidence due to my interest in carcinogenesis and knowledge in diagnostic radiology. **Every BCEC requires the identification of not only the electric potential difference among tissues but also the closed circuit path for the flow of electricity.**

The BCEC, existing at metric levels, seem to be most easily identified. But few realize that e.g. the contractions of the heart muscle require a specific Vascular-Interstitial-Neuromuscular Circuit (VINMC) to be activated. Its pulses proceed over closed circuits for activation of the heart muscle. Secondary to these pulses, induced fields can be recorded in ECG tracings. An interruption of cardiac VINMC can be repaired by means of pacemaker technique. More difficult to recognize are the cellular and subcellular BCEC-systems. The flow of ions in membrane channels such as recorded by Neher and Sakmann, does also require closed circuits. The most possible "return flow" is likely to take place via redox proteins in the cellular membrane with transfer of electrons across the membrane leading to anodic and cathodic reactions.

Each BCEC will require a separate research program with cooperation between biophysicists and biologists. A survey program for such activities is found in the "Afterword" by Prof. Paul J. Rosch, M.D., F.A.C.P. Besides these examples there are an abundance of structural and functional BCEC-effects, which may be recognized. Of particular interest is e.g. the EMF-guidance of outgrowth and structuring of blood vessels ^(1, pp. 152-156) and possibly also nerves.

Björn Nordenström

July, 1998

Acknowledgement

To my wife Gerd and my sons Jörgen, Hans and Klas for their invaluable help and support during the last distressing years of my handicapping disease.

To Ms Kerstin Ersson, Secretary to the Department of Diagnostic Radiology, Karolinska Institute and Hospital, Stockholm, Sweden. Without her skill and never failing endeavors in correcting and typing the often unreadable manuscripts the present publication could probably not have been finished.

Björn Nordenström

July, 1998

1. Introduction

The primary purpose for this book is to serve as an extension of a previously published book “Biologically Closed Electric Circuits” (BCEC) ⁽¹⁾. The fundamental principle of closed circuit transport of electricity in biological systems can be utilized to show how external and internal electromagnetic fields can interact with the BCEC-systems.

In the exploration of factors involved in the development of our physical world, it has long been evident that the Electromagnetic Field (EMF) plays a fundamental role. Related studies have also taught us how to utilize various characteristics of the EMF. Thus, a closed circuit flow of electromagnetic energy, and its ability to promote co-transport with electrons, is utilized in technology for powering of various electrical devices and systems. This capability has been revolutionary for mankind. Similar EMF relationships and phenomena exist in biology where the closed circuit flow of EMF with co-transport consisting primarily of ions has recently been described in terms of different sorts of Biologically Closed Electric Circuits (BCEC) ⁽¹⁾.

In this book, we will study the EMF and the principle of its flow in closed circuits. This can help us to understand a wide variety of biological phenomena which are still obscure and difficult to explain in conventional biophysical models.

2. A Guiding Philosophy Often Initiates Developments

The founding of e.g. a political party, religion or society are examples of innovations which have to follow some rules of a basic philosophy. In addition, for various scientific situations, a basic philosophy is necessary, e.g. in the descriptions of conversion of energy.

In the 5,000 year old **Oriental philosophy** ⁽²⁾ the conversion of energy of the universe deals with an assumed existence of a universal circulating energy called Chi. The energy conversion is described in the concept of

Tao to follow certain rules which make Nature and its behaviour explainable ⁽³⁾.

Like the Hinduist Braman and the Buddhist Dharmakaya, the Tao is the order of Nature or the Cosmic Process, and man has to live in harmony with this order ⁽⁴⁾. In doing so man will recognize the cyclic motions of energy in Nature in its expansion and condensation. The cyclic movements of planets was extrapolated into the cyclic movements of two opposite components of Chi, called Yin and Yang. They represent dark and light, male and female. Yang is the strong, creative, active and male. Yin is the receptive, passive, intuitive, female element⁽²⁾. The cyclic dynamics of Yin and Yang is described as the Chinese symbol of the T'ai-Chi-T'a ⁽⁴⁾.

The energy of the universe consists of Chi which is shapeless. By condensation it creates all shapes. The pathways in the human body for Chi energy are the structural basis for the understanding and the influencing of health and disease in ancient Chinese medicine. The flow of energy represented by Yin and Yang takes place in meridians ⁽²⁾. Imbalance of the components of Yin and Yang results in disease. Yin and Yang can be influenced on by e.g. acupuncture, moxibustion, electroacupuncture(!) and acupressure. The energy concept (**philosophy**) of Chi has resulted in extensive and complex conclusions dominantly **related to biology and medicine** ⁽²⁾. The energy of Chi is assumed to be responsible for the movements of planets but is not described as the power source for technical constructions.

The Oriental concept of Chi has an Occidental (Western) correspondence in the Electromagnetic Field and the Field-relation to Electricity. In particular, one form of electricity has been used extensively in technology all over the world. This form involves electromagnetic field flow with co-transport of electrons in metallic cables, which may be called **Electronic Electricity** (Fig. 1a). The background Guiding Philosophy consists of the unified extensive knowledge of the characteristics of electricity with its capability to perform work utilizing closed circuit flow in metallic cables.

Chi is described as a powerful energy which can influence health and disease in biomedicine. But Chi is not utilized in technology.

The contrary is found in the use of electricity with its extensive utilization of Electronic Electricity in technology while the use of electricity in biomedicine is poorly developed. **For therapeutic purposes** in biology today, electricity is successfully utilized in the induction of signal-activation

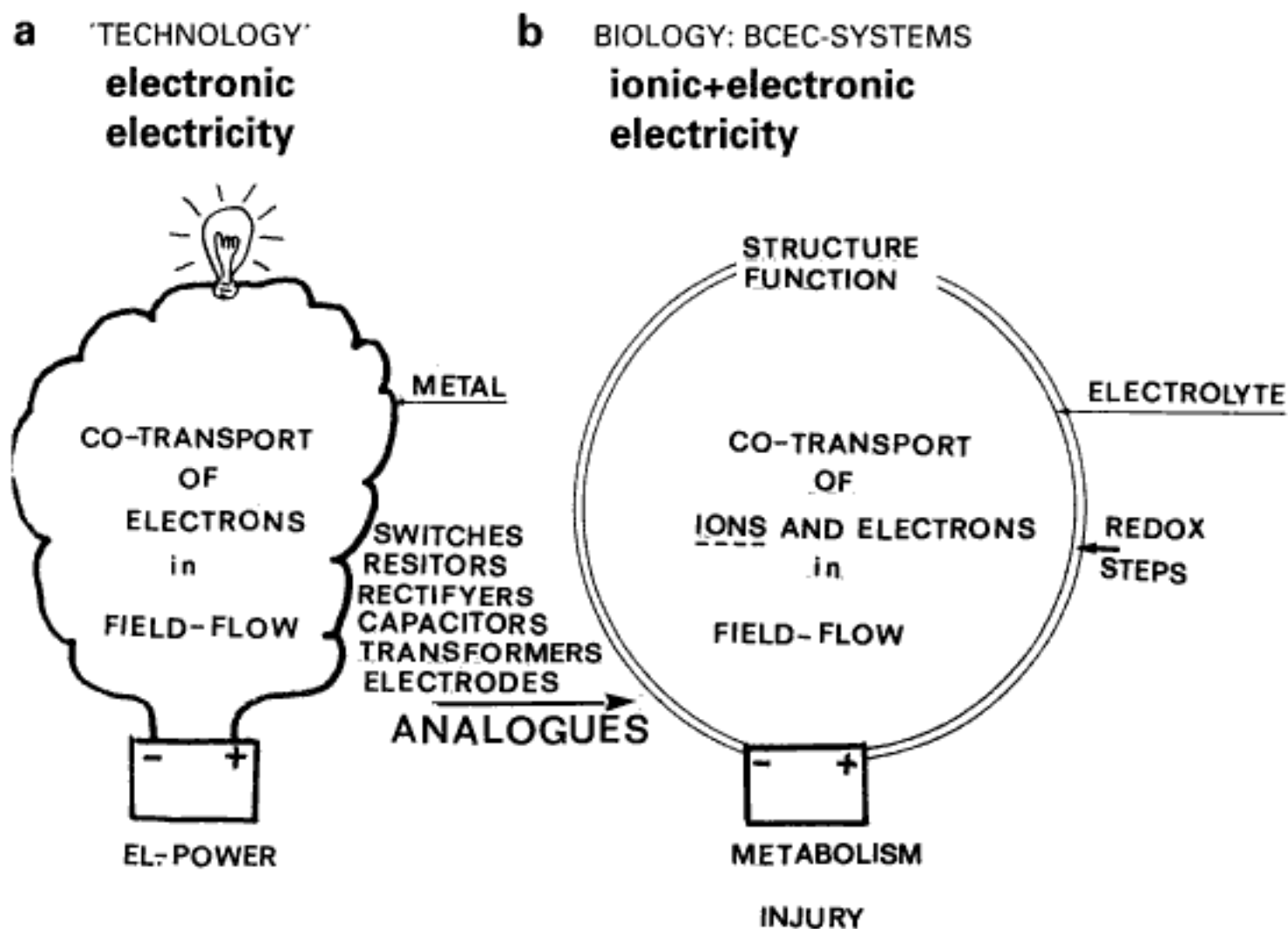


Fig. 1. Comparison between powering of "technological" constructions such as electrical motors, lamps etc when only electrons make co-transport with the EMFs in metallic cables: i.e. **Electronic Electricity** and (b) the powering in Biology which takes place over Biologically Closed Electric Circuits (BCEC) when dominantly ions but also electrons make co-transport (in short redox steps) with the EMF: i.e. **Bioelectricity**.

of vascular-interstitial-neuromuscular circuits in **Cardiac pacing** ⁽⁵⁾, in Electrochemical treatment of cancer (**EChT**), in Electroconvulsive treatment (**ECT**) and in Electro-coagulation using **diathermia**. For **diagnostic purposes** the function of endogenous closed circuits are studied in **Electrocardiography**, **Electro-encephalography**, **Electromyography**, etc.

It is now easier to understand and utilize electricity in biomedicine with the principle identification of Closed Circuit Flow of Electricity in Biology taking place in **BCEC-systems**.

The **BCEC-concept** may therefore be used as a **Guiding Philosophy** for identification of the specific **BCEC-systems**, the understanding of their function and the extended use of electricity in **Biomedicine** (Fig. 1b).

3. Electricity

In Fig. 1 is a comparison made between (a) electronic electricity powering “technological systems” such as electrical motors, light bulbs etc and (b) ionic and electronic electricity powering biological matter, leading to structure and function in Biology by the utilization of BCEC-systems.

In system (a) an electromagnetic field is flowing through a closed circuit of metal cables. The flowing field **makes co-transport** with charged particles. The charged particles which can follow the field in metal cables are **only** electrons. The technological systems in Fig. 1a are therefore powered by **Electronic Electricity**.

The situation in Fig. 1b is more complex. In this case, the field is flowing in closed circuits of electrolytes such as blood vessels with their conducting plasma and in lymph fluid, intercellular fluid etc. Therefore, the flow of electricity is dominantly **Ionic Electricity**. For function in biological systems, short steps of electron transfer are required. In cellular membranes redox protein molecules are present with the capacity to transfer electrons from one side of the cellular membrane to the other. These molecular redox functions contribute to **rectification** in the ionic transport mechanism. **The BCEC-systems are therefore powered by dominating Ionic Electricity supported by short steps of Electronic Electricity.**

Biologically closed electric circuits (BCEC) do not only cover important parts of ionic transports, but they are also prerequisites for biological structure and function. This means that, in biology, there are equivalent mechanisms that are present in “electronic technology” such as switches, transformers, rectifiers, capacitors, electrodes etc. They are Nature’s electrical components which function with remarkable efficiency.

An EMF can pass through any medium, including insulators. If movable charged particles are present beyond an insulating medium through which only the EMF passes, other charges beyond the insulation can be “displaced” by the field. This flow of the EMF with local co-transport of charged particles is called **displacement current** ⁽⁶⁾, which is associated with current flowing in capacitors.

4. The Electromagnetic Field (EMF) ⁽⁷⁾

Of particular interest to us is the electromagnetic form of energy described as the Unified Electromagnetic Field (Fig. 2). It is also called the Wavy Field. The Wavy Field fills the entire universe and is present everywhere. This is possible because the EMF penetrates almost everything. The field consists of various “amplitudes” and “wavelengths” of oscillations and circulates continuously. The “amplitude” and “wavelengths” are evidently not two-dimensional as may appear in their conventional presentation of Fig. 2. Instead the field components expand in all spatial directions. The expansion can present anodic and cathodic EMF (spiral) vortices (Fig. 3a). The EMF-vortices are spiral motions in gradients of the fields ⁽⁷⁾. They can disclose ⁽⁸⁾ the presence of the electrical field (E) and the magnetic field (H) (Fig 3b). The EMFs in circulation can promote the co-transport of particles that have a surplus of charge or an induced separation of

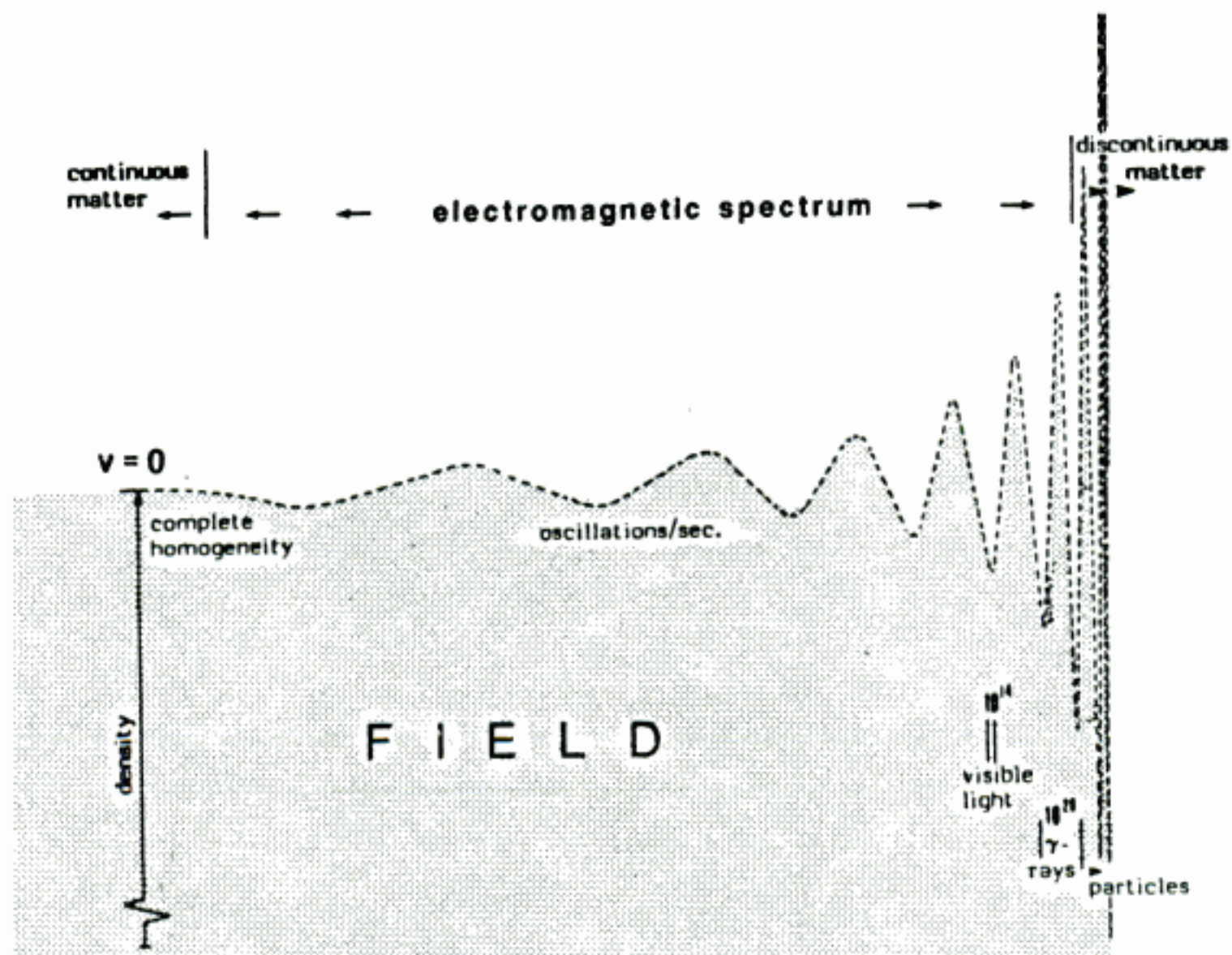


Fig. 2. Conventional presentation of the electromagnetic spectrum. The EMF forms links of continuity and discontinuity of matter and functions.

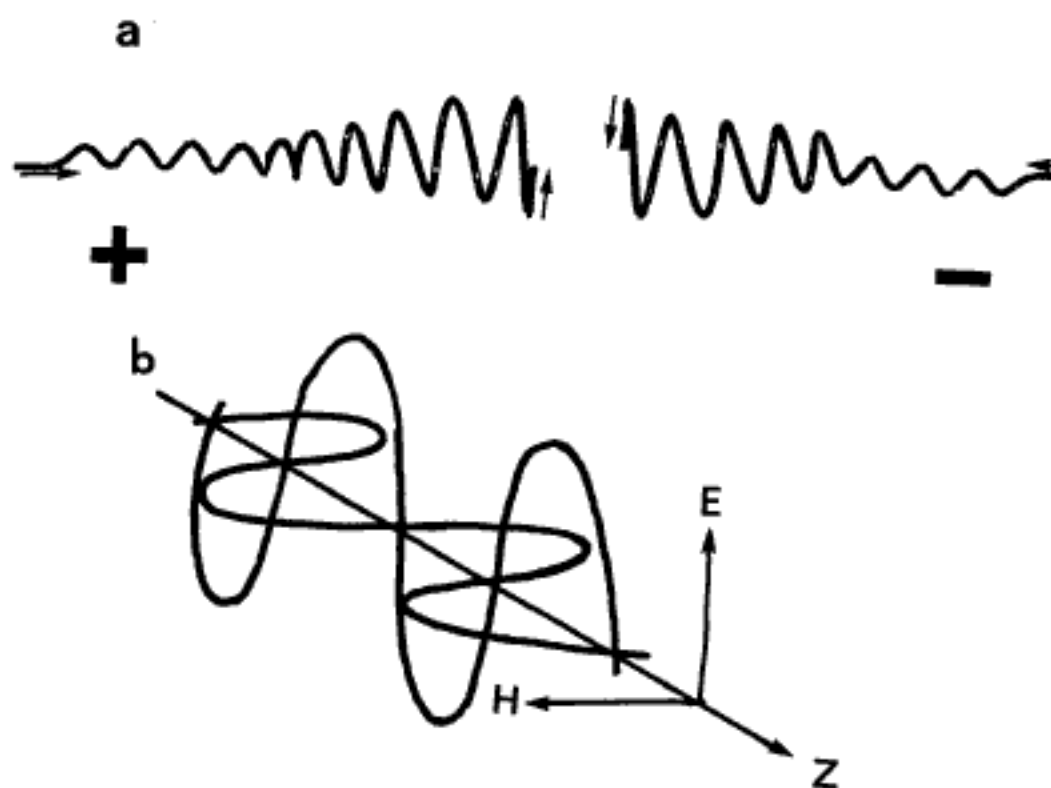


Fig. 3a. EMF expansion in a field gradient, illustrated by metal spirals imitating EMF-vorteces. Anodic and cathodic vorteces give co-transport of charged particles in the directions of the arrows.

Fig. 3b. Propagation of an electromagnetic vortex (spiral). Z = Direction of propagation. E = Electric, H = Magnetic vectors.

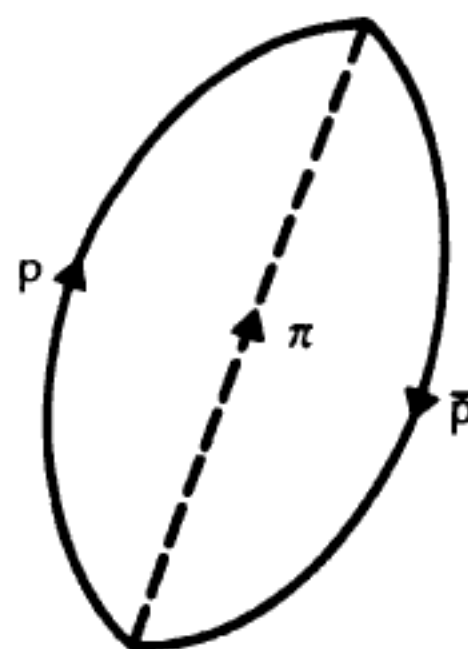
charge. The motion of charges induces the flow of the electro-magnetic field components. When a magnet is moved over a conductive ring, electrical current flows in the ring. The flow of electrical current in the ring also induces electromagnetic flow ^(9, 10).

5. Matter of our Physical World

The unified electromagnetic field of the universe (UEMF) can, by condensation, appear to us as particles (i.e. matter). Particles then aggregate into atoms, molecules and various complex structures. But all matter will subsequently decay (regress) and return to the UEMF which continues in an eternal circulation. These events have been illustrated by F. Capra ⁽⁴⁾ in a so-called vacuum diagram (Fig. 4) for non-biological matter. This figure indicates that matter decays into its constituent parts.

Einstein's equation ⁽¹¹⁾, $E = mc^2$ indicates that there is a close relationship between mass and energy. Therefore, matter can be thought of as "transformed" electromagnetic energy possessing particular wavelengths.

Fig. 4. Vacuum diagram (F. Capra), shows a proton (p), an antiproton ($\bar{p}$) and a pion (π) as examples of the continuous development of matter by condensation of EMF of the universe into particles. The particles proliferate into atoms, molecules, various non-biological structures and so on. All matter then regresses (decays) to return to the EMF. The events represent a circulation of EMF energy which goes on forever. This circulation of non-biological matter – energy – will here be extended to include also biological matter.



Everything in our physical world undergoes proliferation from the EM field and regression back to the EM field, as a circulation of changing expressions of energy ^(11, 12, 13).

It is proposed here that biological matter, which consists of the same type of atoms as those in non-biological matter, also undergoes proliferation, aggregation, and regression. These processes are mediated by a particular mechanism, which “fully” developed, involves the general theory of Biologically Closed Electric Circuits (BCEC). These circuits already exist in salt-water of the oceans. Electrophoresis in primitive closed circuit channels in conducting salt water can therefore promote “auto-proliferation” of BCEC systems. These basic processes assist in the transformation of non-biological matter into biological matter. The BCEC theory can be coupled to the theory of biomolecule development by Oparin ⁽¹⁴⁾, Orgel ⁽¹⁵⁾ and Miller ⁽¹⁶⁾. In a glass container, Miller mixed water, H_2 , NH_3 and CH_4 together. He exposed this “soup” to electric discharges for one to two weeks. Chemical analyses of the content indicated the presence of many essential amino acids and many other biological compounds ⁽¹⁶⁾. Miller’s experiments have been criticized because of the low concentration of the compounds in the sea-water (after precipitation) and other “contaminating” compounds. It will be shown that the BCEC-mechanism should be able to compensate for the low concentrations by enhancing the coincident contacts of the various compounds. This would give support to Miller’s experiments. Further, a theory will be presented describing how BCEC mechanisms could transfer non-biological matter into biological matter. This additional theory has prompted additional considerations concerning

the general background of circulation of energy. In these studies the fundamental questions of progression of matter (leading to life) and regression (leading to death) have given indications that both non-biological and biological matter are bound to participate in an eternal circulation.

The atoms are basic “building blocks” of matter. They are of identically equal appearance in non-biological matter as in biological matter. Another characteristic of matter which has its correspondence in biological matter is the development (proliferation) of various compounds which, later on, proceed with regression (decay). This transition of non-biological matter often takes a very long time, compared to biological matter. Biological matter tends to proliferate and regress (decay) more rapidly. The difference is tied to the mechanism of Biologically Closed Electric Circuits (BCEC). The driving energy of BCEC has its origin in the EMF of the universe and is a basic mechanism of developing biological morphology (structure) and function. The circulation of EMF exists in non-biological matter as well as in biological matter. The two types of matter both seem to “remember” their origin in the electromagnetic field of the universe, which promotes the circulation process.

The energy associated with matter and electromagnetic fields is difficult to define in spite of being a fundamental concept in physics. It is partly so because energy appears to us in many different, transient forms and functional expressions. Let us start with a simple example.

The burning of firewood (energy, appearing as matter) requires interaction with another energetic form, oxygen. This results in flames (light energy), heat, and the energy of ash. The heat may interact with water (energy), giving rise to the pressure-volume exchange energy of steam. A steam engine further can transform the vapor-pressure into linear or rotational, mechanical energy and drive a generator, producing electricity etc. These events are understandable, but the common background denominator is difficult to define. Various forms of energy can also interact, leading to what may be called chemical or physico-chemical reactions.

The background physics of “chemical” energy components was defined by Nernst. There exists four kinds of energies; strong molecular, weak molecular, gravitational and electromagnetic fields.

The various forms of energies circulate within the general energy field of the universe. A materialized correlation between “Empty Space” and Matter was described by Einstein ⁽¹¹⁾, who stated that there can be no space

or any part of space without gravitation. The **cosmic Aether** of Newton, filling the “Empty Space” represents also an attempt to materialize a transitional phase which may also be approached in theology. Newton ⁽¹²⁾ tried to give it a descriptive functional definition and talked about Sensorium Dei (Sense of God). From this definition, there is still a large gap in our ability to define a **Common Guiding Principle** of metaphysical, ontological transformations of the general energy field, which should enclose all the physical and theological concepts ^(13, 17).

6. Prerequisites for the Presence of BCEC (Biologically Closed Electric Circuits) ⁽¹⁾

- The origin of physical entities involves energy of various forms.
- Energy is the origin of our physical world.
- The electromagnetic field (EMF) is one basic form of energy, which after “condensation” can appear to us as particles (i.e. matter).
- These particles form larger units of matter such as atoms, molecules etc (Proliferation).
- The EMF always circulates everywhere, changing its appearance by **condensation or by expansion**. The latter event tends to produce EMF-vortices (spirals).
- All matter will, after the phases of Proliferation, enter the phases of Regression, returning to its origin, the EMF.
- Proliferation (P) and Regression (R) form a balanced circulation where $P+R=0$.
- The EMF can therefore circulate eternally.
- The circulation of Matter (energy) into Biological Matter (energy) proceeds in processes involving Proliferation and Regression (Decay), within the mechanisms of Biologically Closed Electric Circuits (BCEC).
- In principle there is no difference between circulation of non-biological and biological matter, except for the intensity and speed of circulation giving qualitative differences, subtle structural variations and differences of function.

- Life and Death represent Proliferative and Regressive phases of the General Circulation of EMF-Energy. The circulation is a result of the thermodynamic constraints involving conservation of energy.
- **The EMF is therefore the fundamental basis of our physical world and constitutes a basis for the BCEC-systems.**

7. Certain Characteristics of BCEC-Systems ⁽¹⁾

There are multiple BCEC-systems of bioelectricity flowing in circuits at metric, to cellular and subcellular levels ^(1, pp. 122–132).

Closed circuit conductive systems for ionic transport were first identified in blood plasma, intercellular fluid, lymphatic fluid with conductive properties about equal to physiologic saline solution. These elements function like electric cables due to the relative insulating properties of walls of vessels, cellular membranes, ductal walls, fibrous materials e.g. in capsules etc surrounding the conductive media. Thus, the blood vessels are “cables” for ionic electricity (Fig. 5). The walls of blood vessels do have a resistivity 200–300 times larger than the blood plasma ^(1, pp 125–128).

Various closed circuit systems of vessels, interstitial spaces, lymphatic channels, nerve-conducting channels, glandular ducts etc make extensions of these closed circuit channels connecting all organs and cells to each other.

The activation of the closed circuits can take place as an effect of moving (circulating) external or internal EMFs. The circuits are driven by metabolism causing voltage gradients by the actions of nutrients and metabolites. An important activation takes place as injured tissue degrades. This drives the process of healing and tissue regeneration by slowly fluctuating and attenuating the injured tissue potential differences.

The metabolic gradients that drive the biological systems are remarkably small. Thus, the overvoltage that drives an electrophoretic system in biology operates by microvolts leading to flow of microampere currents ⁽¹⁸⁾. The necessary electron-transferring steps take place in the BCEC systems via redox proteins e.g. in cellular membranes. In this way structure and function of synaptic vesicles can be explained in neuro-conduction ⁽¹⁹⁾ processes.

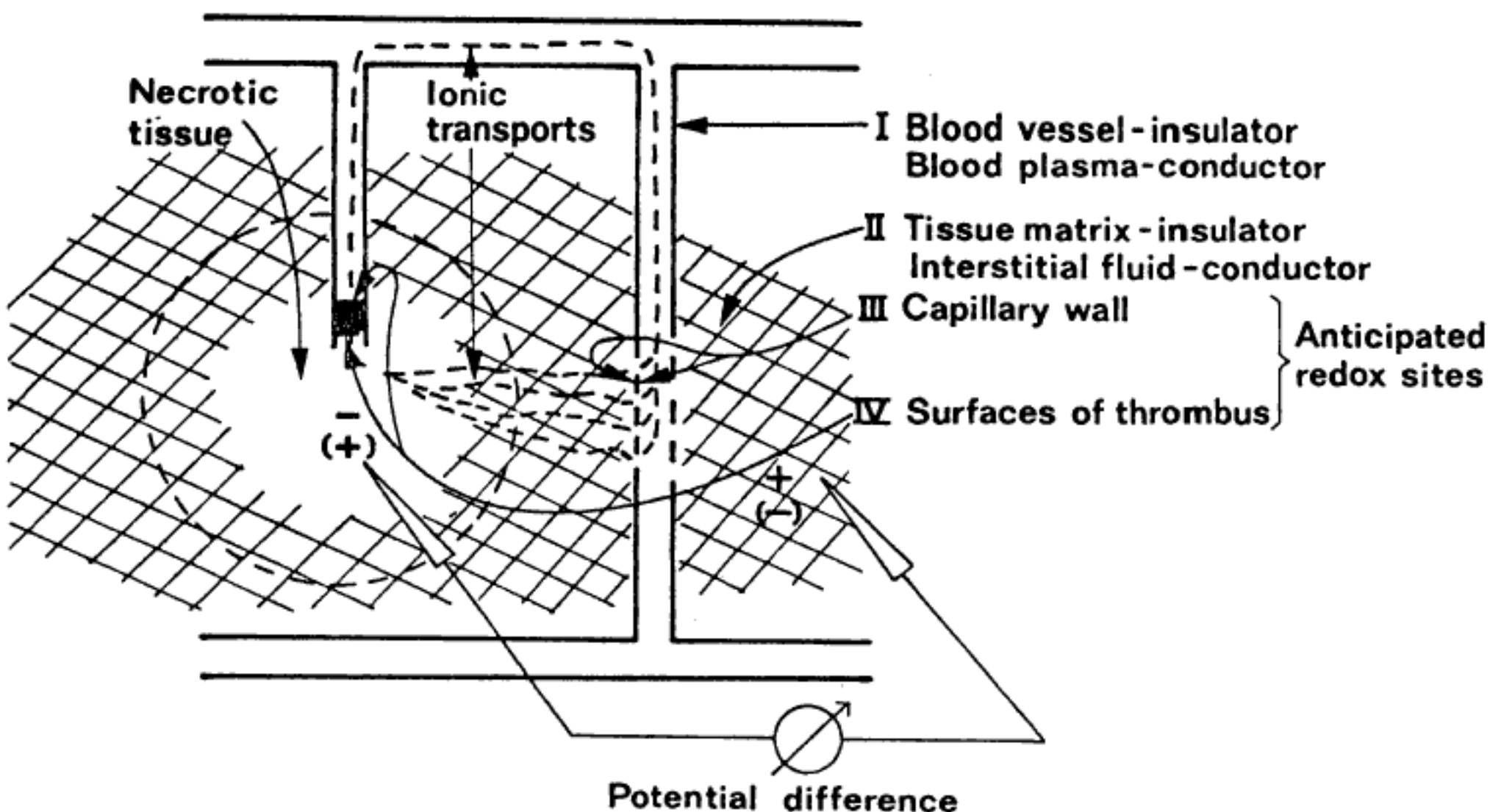


Fig. 5. A common Biologically Closed Electric Circuit (BCEC), powered by a spontaneous necrosis (injured tissue) in a malignant tumor. Potential differences such as between injured and normal tissue or metabolic differences among tissues induce ionic transports in the BCECs.

An important mechanism is represented by the flow of ions in blood vessels, lymph channels and interstitial tissue spaces ⁽³²⁾ producing electromagnetic fields which penetrate the cellular membranes and induce eddy currents inside the cells (Fig. 6).

The circulation of the EMF-energy of the Universe can be recognized at a miniature level in the BCEC-systems. Activated, these “miniature circuits” seem to **remember** their origin in the EMF by expressing a “tendency” involving Expansion and Concentration to balance the various phases of proliferation and regression, i.e. input, output, conversion and utilization and expense of energy in an endless circulation.

The BCEC-systems are not only systems of conducting cables, they also contain the biological analogs of electronic switches, resistors, amplifiers, capacitors, electrodes, etc. Each cell of the body is a “leaky” capacitor due to its resistive fibrous membrane and conducting intercellular contents.

The cells are “leaking” and charged by closed circuit ionic flow via

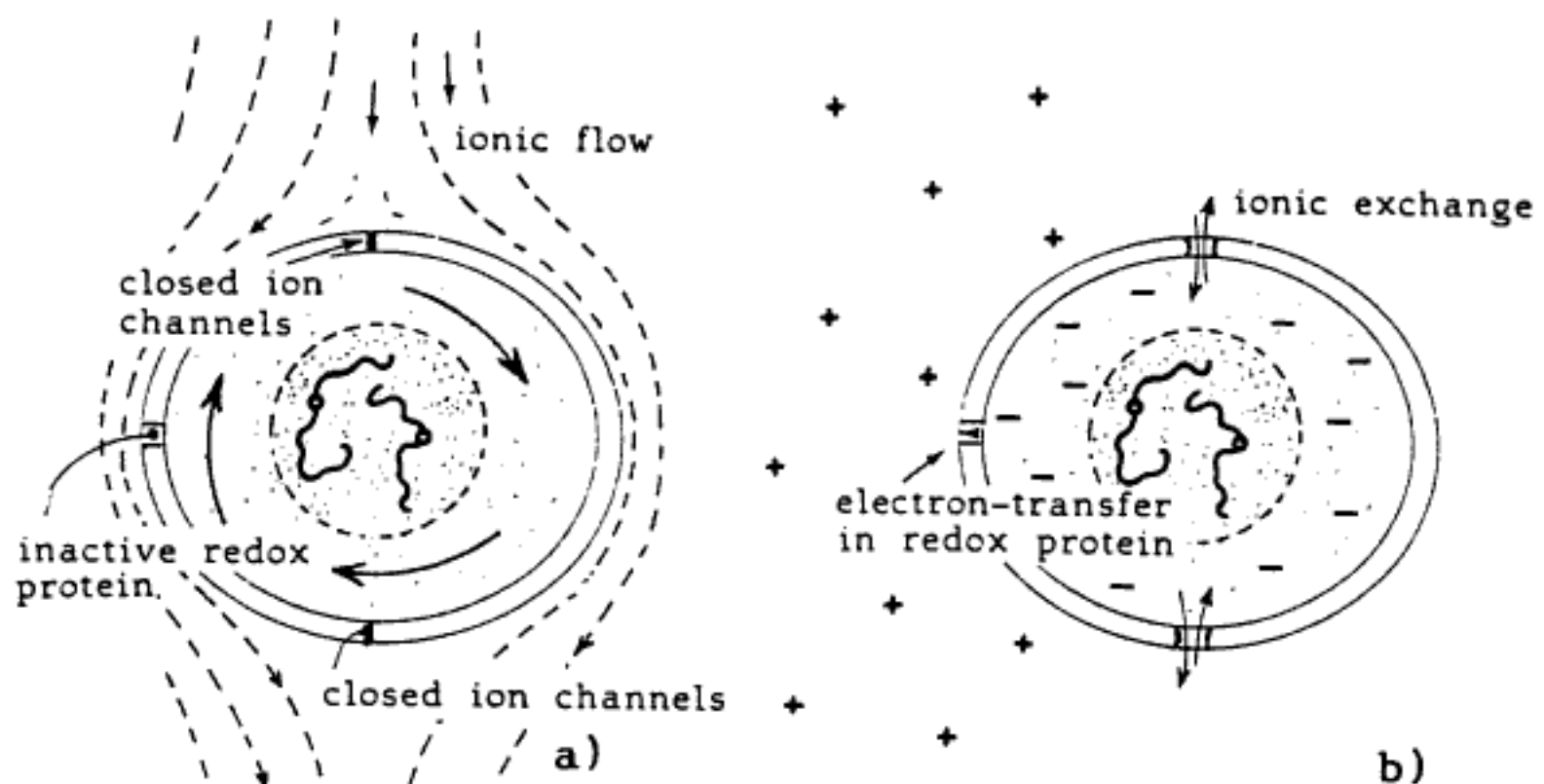


Fig. 6. Ions flowing in interstitial spaces between cells will induce eddy currents inside the cells in the conductive cytoplasm also if the ionic channels of the cellular membrane are closed. The EMF flows through the relatively insulating cell membrane.

membrane channels which promote the flow of electrons via redox protein chains imbedded into the cellular membrane. So, in fact, these are short pathways involving the flow of electronic electricity in BCECs (1, pp 4, 144-150, 321). Various tissues and organs are also internally conducting and surrounded by insulating sheets such as organ capsules. Organs therefore leak via blood vessels, nerves, ducts and lymph channels. The body contains conglomerates of communicating (leaking) cell and organ capacitors. In fact, the entire body appears to be a leaking capacitor surrounded by relatively insulating skin. The leakage takes place via sweat pores, gastro-intestinal and urinary canals etc. Due to the capacitive properties of the body and internal flow of ions an EMF-corona extends outward all over the skin surface. This EMF-corona can be photographed using the Kirlian technique (Fig. 7). The body has also internal EMF-fields which will participate in structural modifications. Thus, around internally degrading cancers, a **corona** will develop (Fig. 8) which produces eleven radiographically identified structural elements (29).

Understanding the BCEC-systems of the body makes it easy to accept the basic mechanisms and pathways associated with Oriental medicine (30, 31). Influences of the BCEC on kidney function and modifications of excretion of radiographic contrast media and Adriamycin (a chemo-



Fig. 7. The flow of ions in BCECs induce electromagnetic fields which, after summation, extend outside the skin of the body. Kirlian photograph shows the electrical field (corona) outside the skin of a human foot. (Kirlian photography, courtesy of C. Lindmark.)

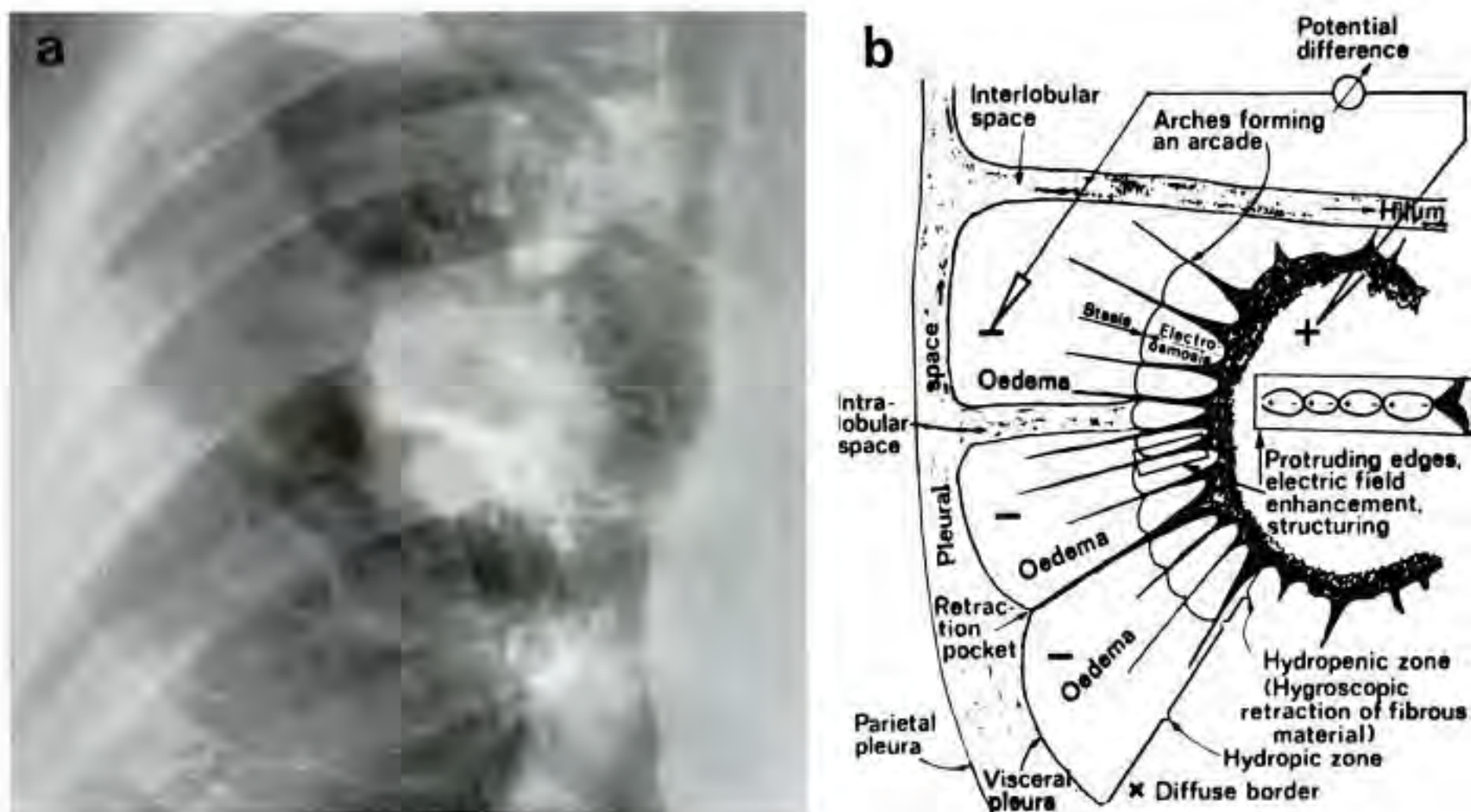


Fig. 8a. Squamous cell carcinoma with central spontaneous necrosis gives injury polarization between cancer and surrounding tissue. Ionic transports in BCECs give rise to **Corona structures** in the body, such as those which are indicated in Fig. 8b.

therapeutic agent) have shown how dramatic changes of the function of an organ can be achieved ^(33, 34). This can be discussed in terms of structure and function in biology ⁽³⁵⁾.

The enormous variability of ions and their interactions lead to rapid “potentiated” differentiation of morphology and function. For such reasons, the most logical form of energy to use for influencing biological systems should be the basic form of energy for all biological structuring and function – **Ionic electricity**. Furthermore, electricity also inherits necessary prerequisites for understanding and definition of abstract terms, such as “signalling”, “recognition”, interactions at specific sites, etc ⁽²⁷⁾.

Special attention has been devoted to the utilization of the **BCEC-systems for treatment of cancer**. The first method is called **Electrochemical Treatment of Cancer (EchT)**. Description is given on mechanisms of the method ⁽³⁶⁾ as well as the second method called **Electrostatic (read Quasi electrostatic) Treatment of Cancer (EST)** ⁽³⁷⁾. Other references ^(38–49) as

well as the presentations by Xin Yu-Ling, 31 of his Chinese colleagues, 11 Swedish, 4 Americans (US) and 4 French researchers dealing with the ECT-treatment of cancer are collected in the **European Journal of Surgery, Suppl. 574, 1993** ⁽³⁶⁾.

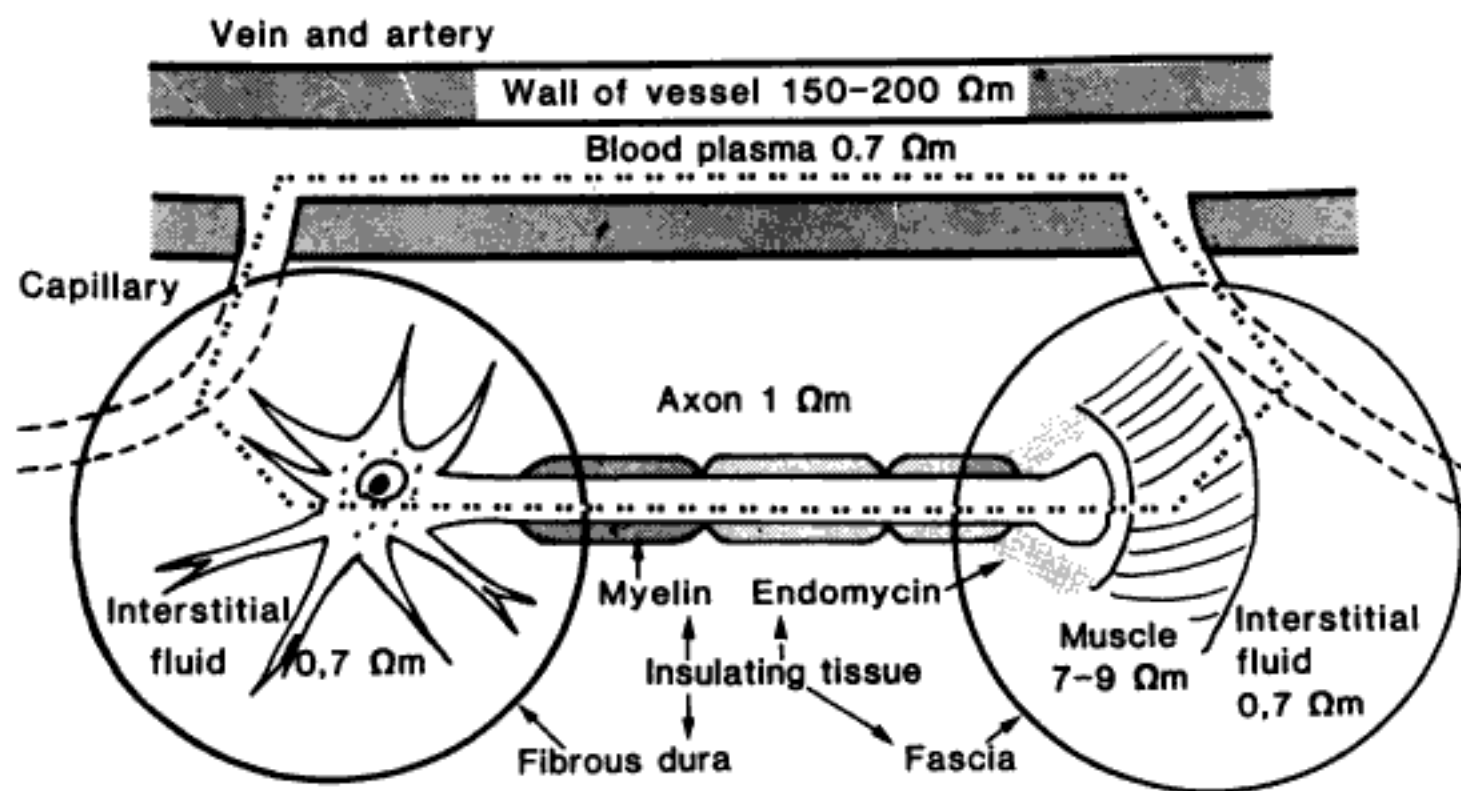
Besides the described characteristics of the BCEC-system, an abundance of physiological and pathological structurings and functions can be related to the electric circulatory system (BCEC) in biology. For further information the reader is referred to the original survey description ⁽¹⁾.

8. EMF-signalling Inducing Displacement of Ions at Activation of BCEC-Systems

The mechanisms associated with tissue interactions with non-ionizing electromagnetic fields, especially interactions with nervous tissue, has been extensively studied by Schwan ⁽⁵⁰⁾ and Adey ⁽⁵¹⁾.

The transformation of current in electrical systems is possible by leading current in insulated cables (coils) through a primary circuit which is positioned close to a secondary circuit with similar insulated cables (coils). The EMF of the primary circuit is transmitted through the insulations to the secondary circuit where the EMF activates (makes co-transport) with available charges (electrons). In this way the EMF produces displacement current induction in the secondary circuit. The EMF of a transformer primary circuit is coupled to the secondary circuit by a time-varying magnetic field (flux). The voltage, current and EMF of the secondary circuit are in this way a result of the process of induction. To a degree, this principle also exists in biology. The flow of ionic electricity is initiated by a tissue polarization (metabolic or injury) with the flow of ions in the interstitial channels. The EMF penetrates the resistive cellular membranes (Fig. 6) producing eddy currents in the cell interior.

Another example is seen in the axons of nerves. When exposed to an EMF, the field associated with a nerve axon is a signal which can easily be transferred a long distance in the resistive axoplasm and activate a secondary circuit, such as the **Vascular-Interstitial-Neuro-Muscular Circuit (VINMC)** (Fig. 9). This circuit is described in detail elsewhere ⁽¹⁸⁻²⁷⁾.



Electrical circuit

Fig. 9. Vascular-Interstitital-Neuromuscular Circuit (VINMC). The conducting axon-synapse-muscle are closed-circuited over the more conductive **interstitial and vascular fluids**, a necessity for the function of the nerve. The VINMC is activated by repeated EMF signals from the brain proceeding in the high resistive axons of the nerve, inducing depolarization of the VINMC.

The signals through axons bombard the nerve cell mebrane of the VINMC, which opens the ionic gates of the membrane of the nerve cell. Following depolarization, this activity leads to ionic activation of the VINMC with synaptic transmitter release and transport ⁽¹⁹⁾, eventually producing muscle contraction. This description deviates from the conventional description of neuromuscular contraction, which is described as being controlled by "saltatory (in fact ionic!) circuits" along the axons. The latter does however not solve the problem of high resistance of the axons. The speed of impulses of ions is only 10-100 m/sec which is too slow for nerve activation by ionic flow at least in large animals. The axons present a high resistance, but permit high EMF-signalling velocities. This leads to VINMC-activation of peripherally located muscles. Is it now possible that EMF-signals can start these events? The question will be answered indirectly.

Fig. 10 illustrates a cow looking at a field of green grass. The daylight EMF carries the photon quanta of the green grass in various directions. The cow sees the fresh, juicy grass. The EMF-signal activates the eyes and the visual memory of the cow. The cow is attraced to the field of green



Fig. 10. A cow sees a field with green, fresh, juicy grass. The photons from the green grass make co-transport with the EMF of the daylight. This co-transport represents a signalling which reaches the eyes of the animal. The activated visual memory of the cow sends new EMF-signals which activate salivation, bile secretion etc and the cow may start to walk towards the field. That requires that EMF-signals from the brain activate neuro-muscular pathways which are described as an EMF signalling activating the vascular-interstitial-neuromuscular circuits (VINMC).

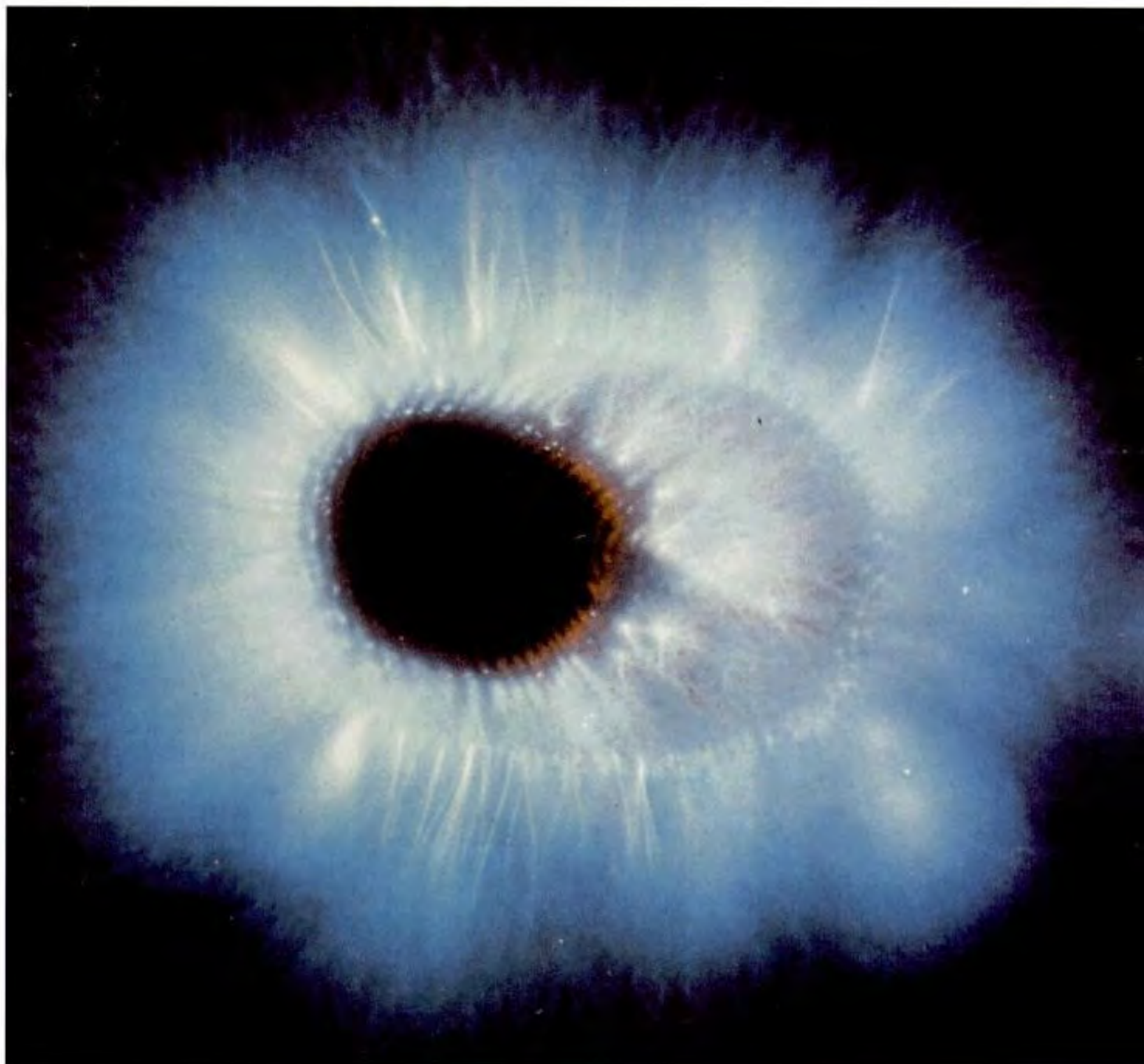


Fig. 11. Kirlian photography showing the electrical fields outside finger tips of a boy and a girl embracing. (Photo courtesy C. Lindmark.)

grass. The EMF-signals travel from the brain of the cow, via nerves, to activate salivation, bile and pancreatic juice of the animal. In this way the EMF-signals from the field of grass can, over a long distance, activate several BCECs.

The activation of VINMC ion channels in the cellular nerve membrane open the channels leading to depolarization. These events activate the VINMC. This gives the necessary energy for activation of the connected muscle fibers. The EMF-signals flowing in the axons will bombard the circuit until the ionic gates are opened. We do not need to bother about ionic conduction in the narrow highly resistive axons.

In Fig. 11, a Kirlian photograph is shown of one finger tip of a boy and a girl embracing. The corona presented here is particularly well developed. In addition, the more ordinary corona (EMF), extending from the palm of the author, is strong enough to have an influence upon the interior of an experimental animal (rat, see Fig. 12) which will be described in the next paragraph.

Fig. 12a shows an angiogram of the tail of a white rat. The tail has one central artery and two lateral veins. These vessels form conducting BCEC-loops with vessels inside the body of the animal (Fig. 12b). Utilizing general pentobarbital anaesthesia, the animal was then placed in a thick-walled (25 mm) grounded iron box. One electrode was placed in the abdominal aorta and one in the peritoneal cavity of the animal. The animal and cables and the recording instrument were all grounded except for the tail of the animal. The tail was pulled out in a hole in the grounded box. When the hand of the examiner with its corona was moved 3 centimeter above and crosswise with respect to the tail, 4 mV fluctuations could be recorded between the abdominal, shielded electrodes in the rat (Fig. 12c). When the hand was moved lengthwise with respect to the tail, the amplitude of the voltage deflections were irregular and smaller (Fig. 12d).

The experiment shows that the internally generated EMF of man, extending from the hand surface, is strong enough to induce EMF-effects deeply in the shielded body of the rat.

The EMF from the body of an animal (or man) can function as a warning signal. A cat taking a walk is shown in Fig. 13. The tail is held vertically in an "antenna position". The internal EMF of the tail tends to separate the hairs of the tail and position them perpendicular to the skin surface of the tail. Therefore an approaching enemy (i.e. a dog) will, with the EMF-

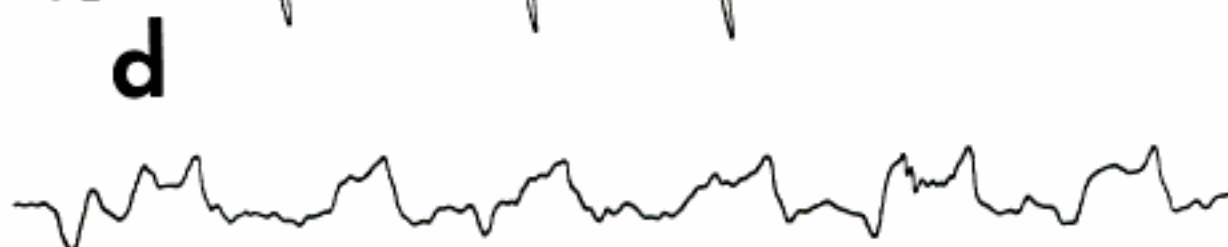
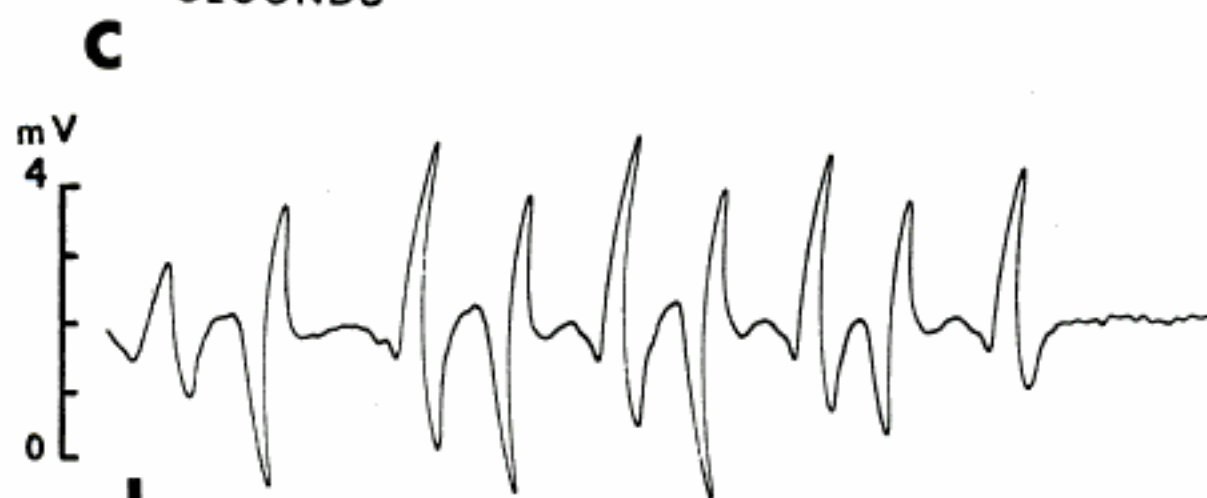
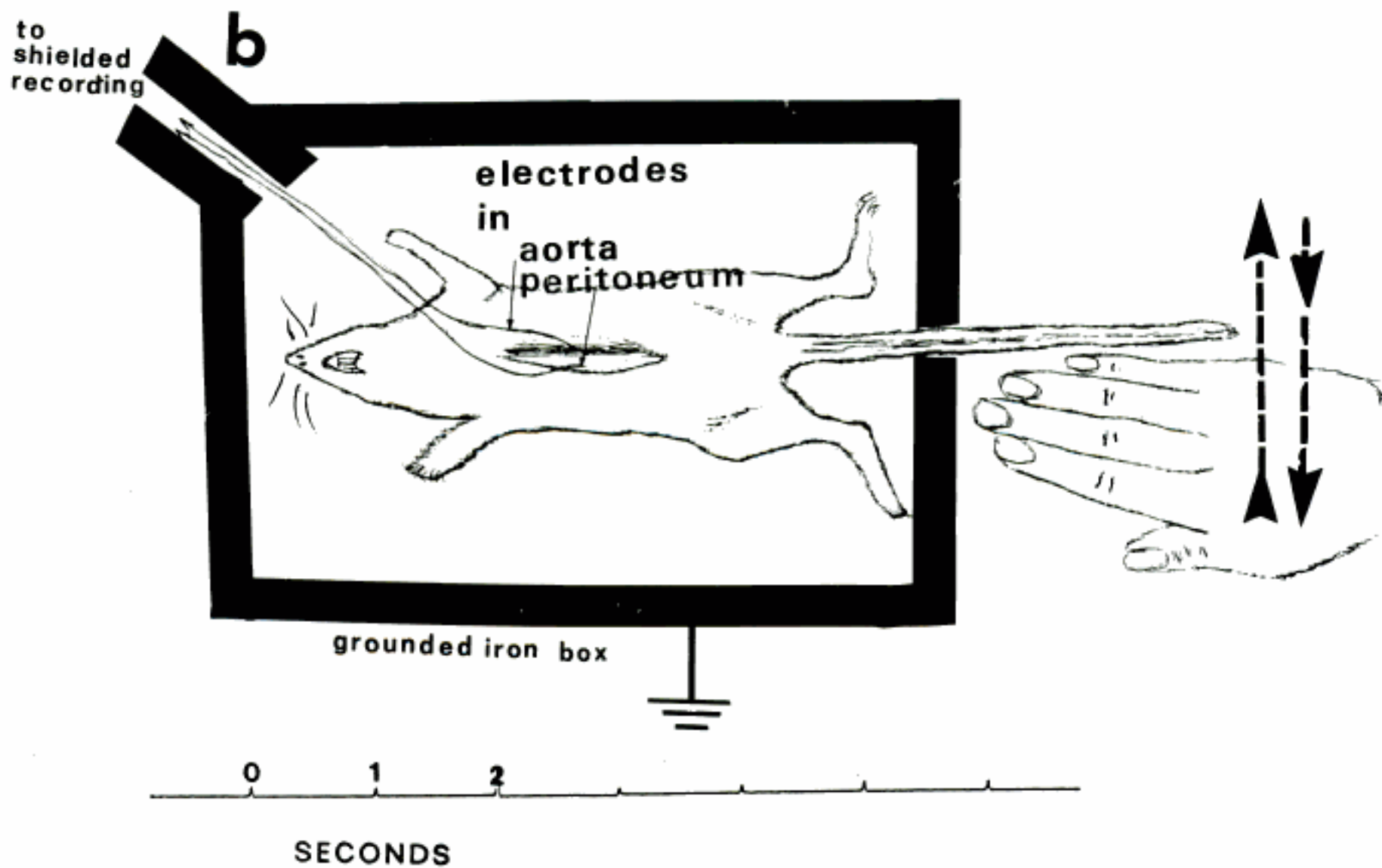
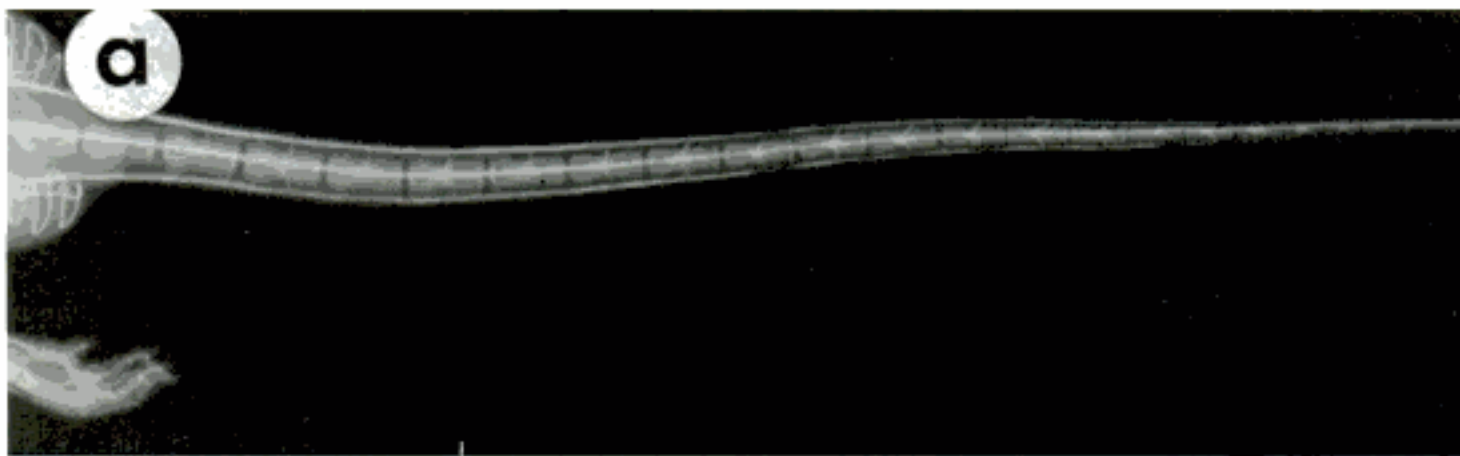


Fig. 12. Legend on opposite page.

- ◀ *Fig. 12. (a) shows angiogram of a rat tail. One central artery and two lateral veins are parts of conductive BCEC loops extending into the abdomen. (b) In general pentobarbital anesthesia one platinum electrode was positioned in the aorta and one in the peritoneal cavity. The rat was shielded in a grounded iron box with 25 mm thick walls except for the tail. The electrodes were connected to a shielded Grass recorder. A hand of the examiner was moved (with its corona) crosswise and 3 cm above the unshielded tail. Large (4 mV) potential differences were recorded between the electrodes. (c) Movements of the hand lengthwise the tail gave lower and more irregular fluctuations. (d) The movements of the external EMF of the hand induce internal voltage fluctuations via the conductive vascular loops deeply in the shielded body of the rat. The BCECs are truly receptor mechanisms for moving external EMFs.*

signals from his body, (a) interact with the EMF-positioned hair on the tail of the cat. What the cat can feel is similar to what we can feel if the back of a hand (which has some hair) is moved across a powered TV-screen and 10 cm from the glass partition of the monitor. The EMF-emission of the TV-monitor will interact with the EMF-corona of our hand which tends to keep the hair in a “radiant” position. (b) The EMF-signal to the tail of the

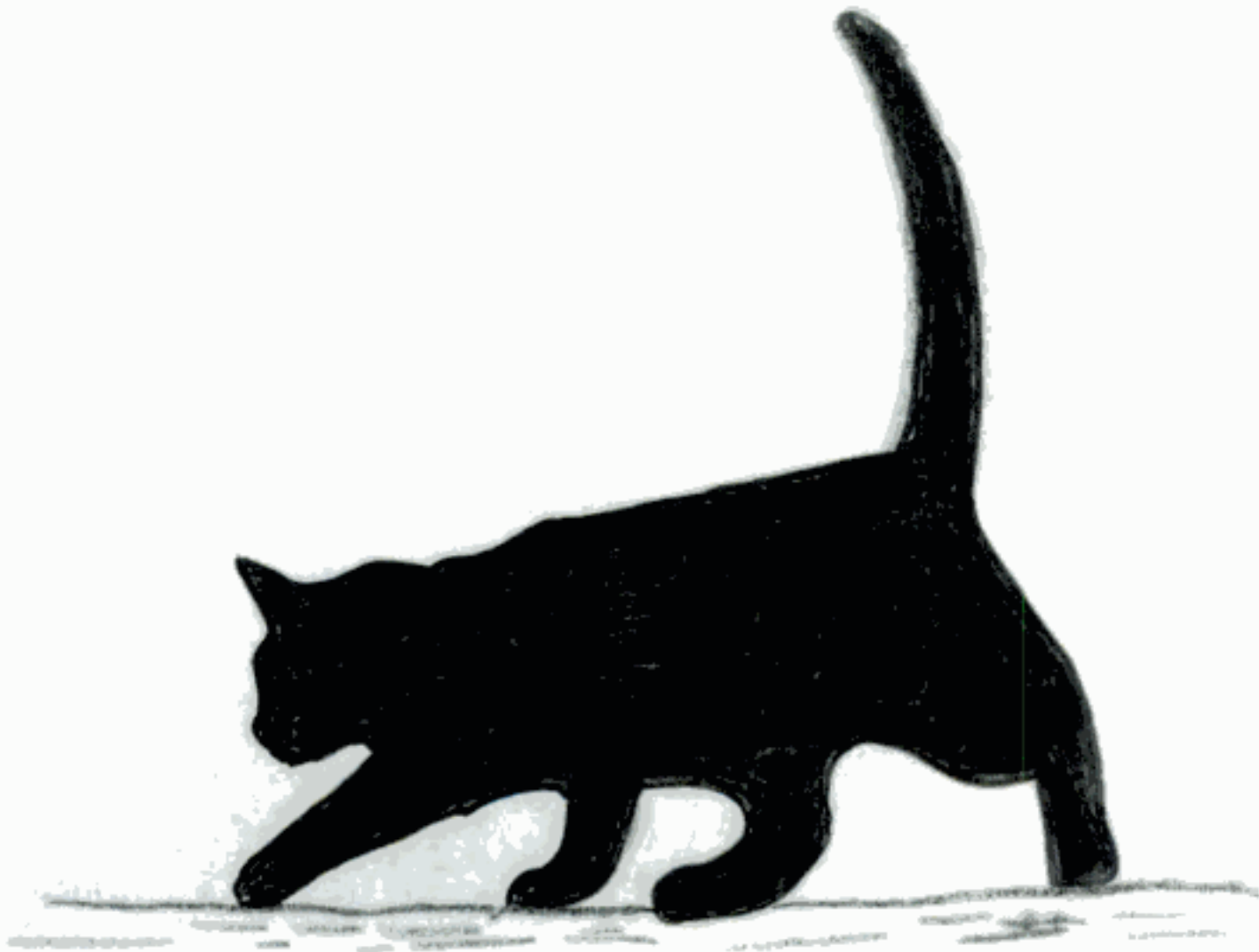


Fig. 13. A walking cat puts its tail in a vertical “antenna position”. The antenna will receive the moving EMF of an approaching enemy, i.e. a dog. The cat will feel (a) the EMF interferences giving motion of the hairs on the tail and (b) the EMF induction of voltage changes of the interior BCEC-systems.

cat of an approaching dog will interact with the interior EMF of the body of the cat in a way similar to what will occur when a hand is moved over the tail of a rat (Fig. 12).

The described antenna function of the tail has many physiological functions in animals besides being organs for keeping the balance. Some of these functions include warnings, localizations, defence and hunting.

9. Self-cleaning Animals

The cat is also a good example of how the fur-carrying animals may keep their fur clean. When moist dust particles adhere to their fur, the particles dry and become dislodged by the internal EMF which extends as a corona of the animal's skin. This makes it easy for them to keep their skin (fur) clean. The dry particles simply fall off by themselves or when the animal shakes its fur. It is remarkable how even a white fur of an animal always looks clean. But we human beings also have a corona from our internal EMF. And still we are not self-cleaning as the fur-carrying animals. The reason for this is probably that the fur-carrying animals do not perspire. But we do, and therefore a clean shirt in the morning is dirty in the evening.

10. Harmful Interactions in Biology

Effects caused by man-made EMFs can now to a large extent be avoided. The BCEC-systems act among other functions as receptor systems for internal and external EMFs. It is thereby possible to understand that persons exposed to the EMF radiation from computers and TV-screens can get skin irritation, itching, headache, etc. Persons sensitive to the EMF of sun-light may even contract skin cancer. A technique to remove the EMF-radiation from computers and TV-screens is described (Prof. Jorge Curé, Magnetic Shield Corp., 6601 Lyons Road, Suite D2, Coconout Creek, FL. 33073, USA).

During the last years electrical energy has been transferred in one direction via one cable immersed in salt-water and the return flow of electricity via the salt-water. This technique requires large electrodes in the salt-water close to the shores, which leads to the production of large amounts of chlorine in the water. Serious electrical fields will also be harmful to the biological life of the sea. These adverse effects can be diminished by letting the return flow of electricity take place via a second parallel cable. These cables will unfortunately still produce harmful EMFs.

A way to avoid these drawbacks is possible by using a coaxial cable, which allows the flow of current in one direction in a central wire and the return flow of current in a tube-like conductor peripheral to the insulated central conductor. The induced EMFs of the two conductors will largely extinguish each other. A remaining field will be taken away by a peripheral, grounded metal screen. In this way no harmful effects will be produced to the biological life at the transfer of electricity.

11. The Electromagnetic BCEC-orchestra(s) of the Body

The extensive systems of closed electric circuits (BCEC) in the body extend from body, to organ, to cellular, molecular and even atomic levels ⁽¹⁾. Every circuit produces its own EM-field, which produces various frequencies, wave-lengths and amplitudes. When individual fields meet each other, they interact by summation presenting constructive and destructive interferences. Small fields (e.g. ionic flow over cellular membrane channels) will easily “drown” in larger fields. This can be explained as a result of summation. To define the spatial distribution of the individual BCEC-fields in tissues at various phases of function is an enormously difficult, or even impossible, task. In a musical instrument, certain tones may present strong, clear sound when resonance occurs. This also occurs with some interacting EMF-fields. The summation (+ and –) of fields among myriads of small and many large BCECs presenting their own interferences also lead to local resonances ⁽⁶⁴⁾. All interferences contribute to our internal

EMF-environment. “Local” defects causing morphological and functional disorders in tissues can, therefore, not simply be substituted or cancelled by external EMFs. You can not correct the disharmony of an orchestra from a disturbing tone by adding new tones. On the other hand, external EMFs can be used to produce “local chaos” of the BCECs among cells of a pathological tissue, such as a cancer. Regression of cancer can be achieved in this way. (See page 37 and Fig. 21a+b.) The application of an external field may stimulate the function of an organ.

12. Why Biologically Closed Electric Circuits?

A circuit does not necessarily mean that it is always closed. Almost all electrical circuits can be turned on or off. Therefore, generally speaking, all circuits are provided with a switch, an important practical component in electrical circuits. In biology, the BCECs are also functioning with “switches” which must be **on** for their functions. The vascular-interstitial closed circuit (VICC) ^(1, pp. 1; 4 pp. 122–150, 318–336) has special cells, the pericytes, which are attached to the outer wall of **arterial** capillaries. When the pericytes are exposed to a positive or negative electric field, a contraction of the arterial capillaries will be induced which will close the “leaking” stomata of the inter-endothelial cells. Instead of ionic transportation through the stomata, electron transfer ^(1, p. 321) is now possible via redox proteins in the walls of the contracted endothelial cells. Blood is shunted to the venous capillaries with the open stomata of non-contracted endothelial cells. At this point, a biologically closed electric circuit is established ^(1, pp. 134–143). Similar biological switches exist in cellular membranes, which open or close the ionic channels located in the cell membranes. These structures also possess electron transfer mechanisms which take place via redox molecules imbedded in the cellular membrane structures.

As a reminder for important biological switching systems involving closed circuit transport of electricity, BCEC is taken as a term for all biological closed circuit systems.

13. Ionic Co-transport – Field Quenching and Proliferation of Matter

Fig. 14 shows an experiment for explanation of the influence of the EMF on matter. Hydrolysis was induced in a T-shaped filter paper soaked in 2M KCl solution with some litmus added ^(1, p. 169). Between two platinum electrodes, 4 V was applied, giving a current during electrolysis of 0.5–1 mA. After 12 hours the left cathodic part is blue (OH^-) and the right anodic part red (H^+). Between these is seen an uncoloured thin (small arrow) line where recombination of water occurs. The blue and red materials do not pass the uncoloured thin line. But the distal parts of the blue and red fields show a clear **accumulation of the blue and the red materials** (thick arrows) close to the uncoloured thin line.

We know that the EMF between the two electrodes has the capability to make co-transport of charged particles such as H^+ and OH^- for colouring litmus. The EMF also has the capability to induce charge separation of dielectric particles in relation to a polarized matrix (such as in electroosmosis). In this experiment, evidently H^+ and OH^- appear to have an influence on litmus which leads to the transport of red and blue coloured litmus material. But the materials do not pass through the uncoloured thin line. To further explain the changes in the filter paper the following experiment was made:

An extension of the previous experiment was made and the recordings are illustrated in Fig. 15 ^(See also ref. 1, p. 166). Four volts were applied between the platinum string electrodes (E_c = cathode, E_a = anode, in Fig. 15a). After start of the hydrolysis, a collection of $n \text{ OH}^-$ (cathodic ionar) and $n \text{ H}^+$ (anodic ionar) ^(1, pp. 159–160) give the blue and red coloring of the litmus containing the KCl electrolyte. By means of a “recording” Ag-AgCl electrode with a salt bridge of 2 M KCl solution, the voltage was recorded first from left to right and then from right to left over the blue and red matrix in relation to a reference electrode (RE) positioned on the “stem” of the filter matrix. Fig. 15b shows voltage recording during the application of 4 volts and the cathodic and anodic colors had developed (12 hours) by migration and diffusion. The left part of Fig. b shows the cathodic blue with variations in the tracing which is dominantly due to gas bubbles in the filter paper (H_2). The negative voltage reaches a zero in the blue-red interphase zone. The

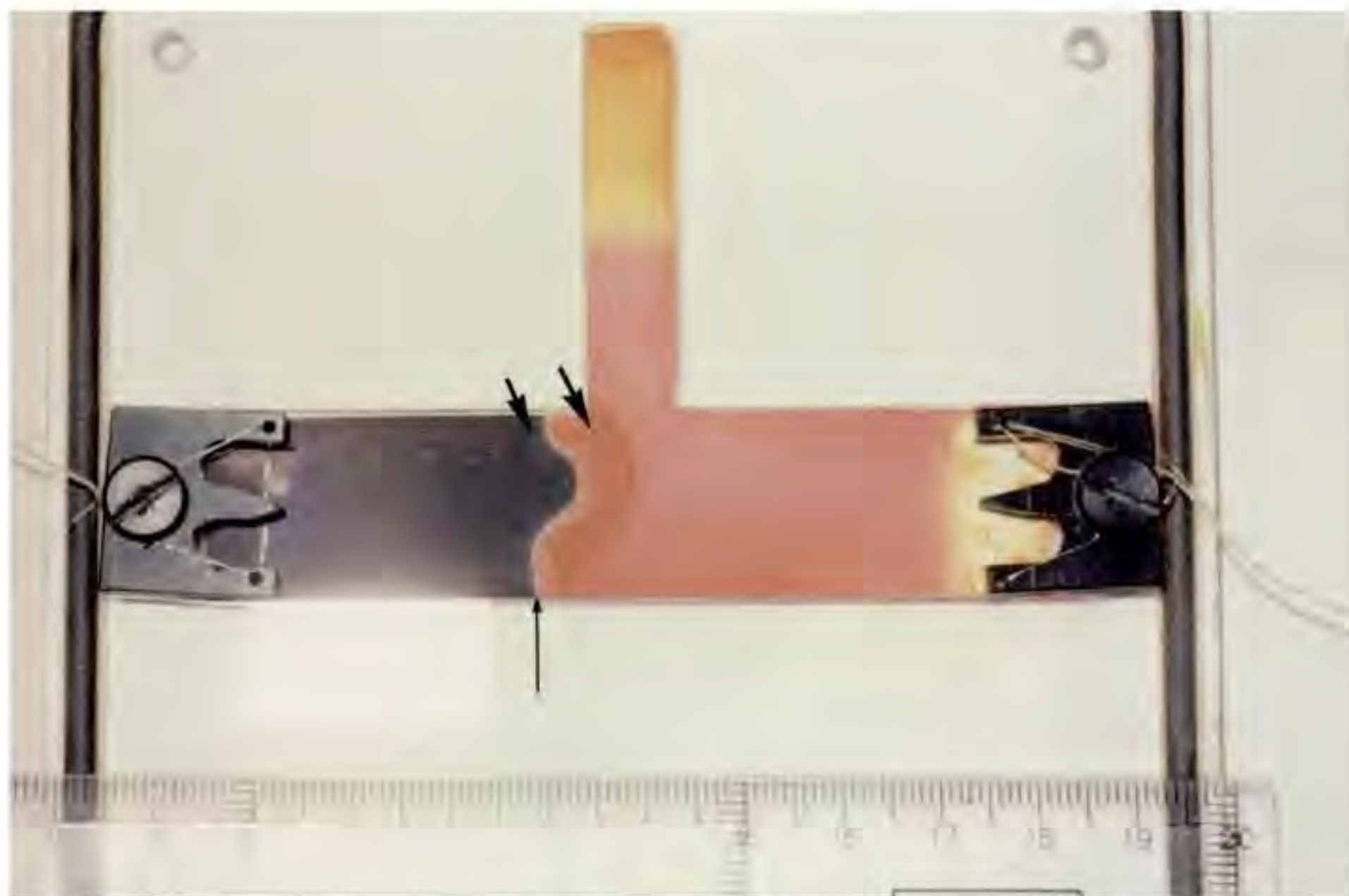


Fig. 14. Electrolysis of litmus-containing 2M KCl-water in filter paper between two platinum string electrodes at 4.1 volts during 12 hours. Anodic red H^+ -litmus and cathodic blue OH^- -litmus move in the field by co-transports with the anodic and cathodic fields. Yellow to the right is caused by bleaching by chlorine. Co-transport of OH^- and H^+ from hydrolysis of water at the electrodes. When + and - EM-fields meet they counteract or even **quench** each other. Litmus stained by H^+ and OH^- are released from the transporting fields when they quench and precipitate, presenting higher concentration under influence of gravitation and concentration forces giving proliferation (thick arrows). Excess of H^+ and OH^- in relation to litmus approach each other by migration and diffusion and recombine at the field quenching, **forming water** (thin arrow) presenting proliferation.

right part of (b) shows a mirror-shape of the left side of the of the tracing. When the external power source is disconnected (Fig. 15c) a minimal leak of current occurs through the recording circuit indicating a self-driving system. Unexpectedly, the cathodic potential is electropositive. This indicates the presence of a disturbing reaction (CO_2 from surrounding air) (See also ref. 1, pp. 165–167). The reversed tracing shows also here a mirror image of the left part of the tracing. The variations in the tracings are due to anodic $O_2 + Cl_2$ gas “pumped” out in the matrix.

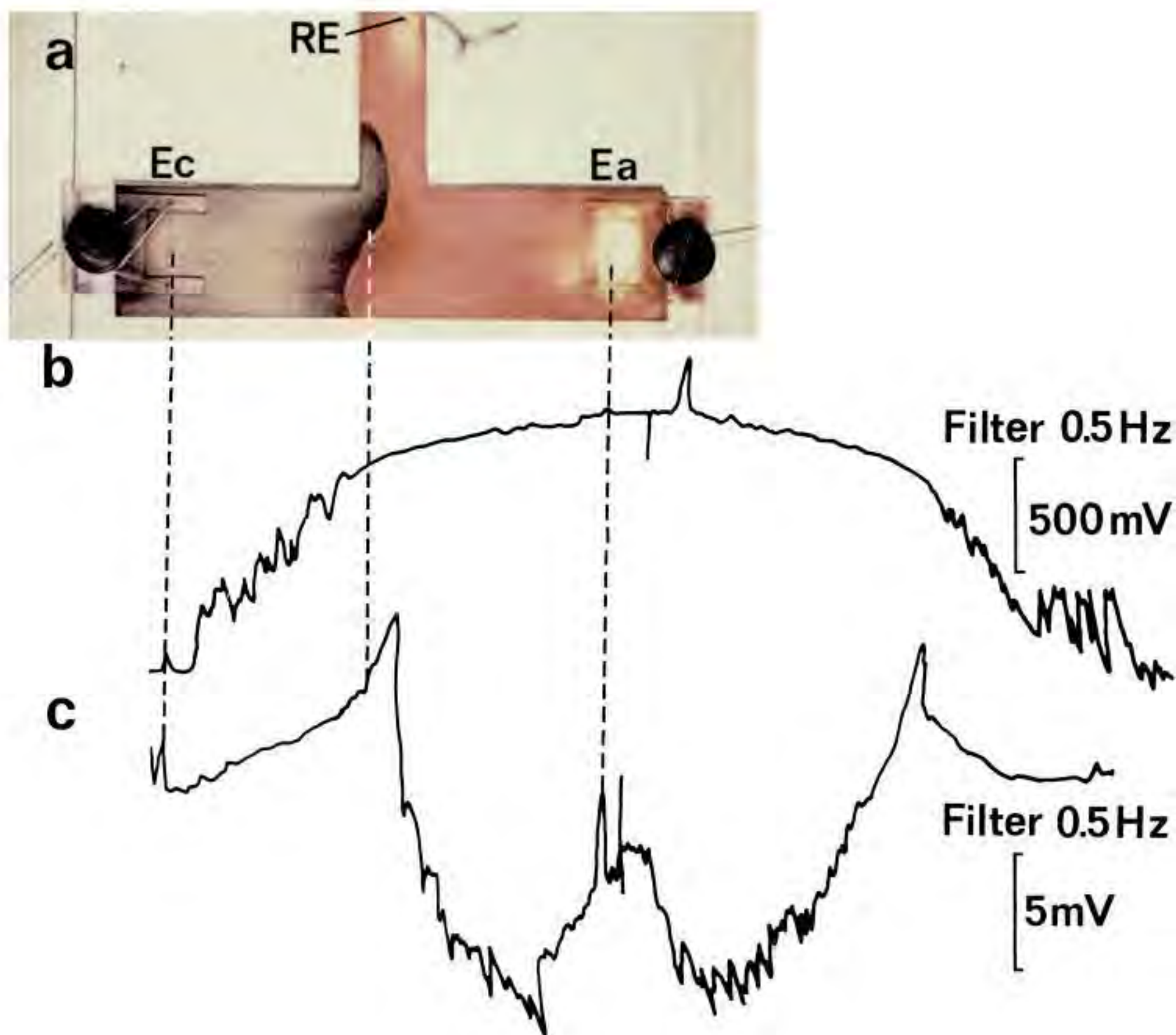


Fig. 15. Extension of previous experiment (Fig. 14). 4 V, 12 hours. OH^- and H^+ stained litmus precipitate where cathodic and anodic fields quench each other. Upper tracing *Fig. 15b* obtained when a "recording" electrode was moved from left to right over the filter-paper in relation to the reference electrode, positioned at RE, during application of voltage between Ec and Ea, and then back. After grounding of Ea and Ec lower tracing, *Fig. 15c* was obtained at moving the "recording" electrode over the matrix from Ea to Ec and then back. Jiggeling of the tracings are caused by the "pumping" of gas evolved at the electrodes Ec and Ea.

The applied voltage (4 V) shows a left positive and right negative field with a zero region here called the recombination zone. In this zone the EM-fields counteract each other, which makes the result of their recombination considerably reduced or even absent (quenched). No possibility of co-transport is possible here. H^+ and OH^- are released from the fields, and by their charges, attracted to each other. Their interaction produces H_2O molecules which are adsorbed to each other (proliferation of water). The blue and red litmus molecules are equally attracted to each other in the anodic and cathodic fields by molecular concentration forces. In other words proliferation occurs for red and blue litmus material and water molecules, O_2 , Cl_2 and H_2 gas.

It seems apparent that litmus material has accumulated at the ends of the anodic and cathodic field. This is possible because the transport function of the **anodic and cathodic fields will, where they meet**, balance (quench) each other. Field transported anodic and cathodic litmus will in these locations not be further transported. They accumulate at the distal parts of the cathodic and anodic fields and proliferate under the influence of gravitation and concentration forces. Charged particles such as H^+ and OH^- ions will meet in the midline and **recombine into water**.

In a three-dimensional electrophoretic instance we can assume that the field structuring EMF-flow will also lead to vortex formation of the co-transported materials.

14. Experimental Demonstration of Vortex Formation in an Electrolyte

50 mm long, light transparent plastic tubes of polyvinyle-chloride with an internal diameter of 2.5 mm and a wall thickness of 0.4 mm were filled with a leading salt-water solution (sodium chloride or phosphate). Litmus (yellow at pH 7) and agar-agar were added. The mixture, heated in a jar and immersed in boiling water, was sucked up into the plastic tubing. Both ends of the tubing were blocked by rubber-stoppers provided with indwelling centrally introduced 0.2 mm thick, 20 mm long teflon insulated plati-

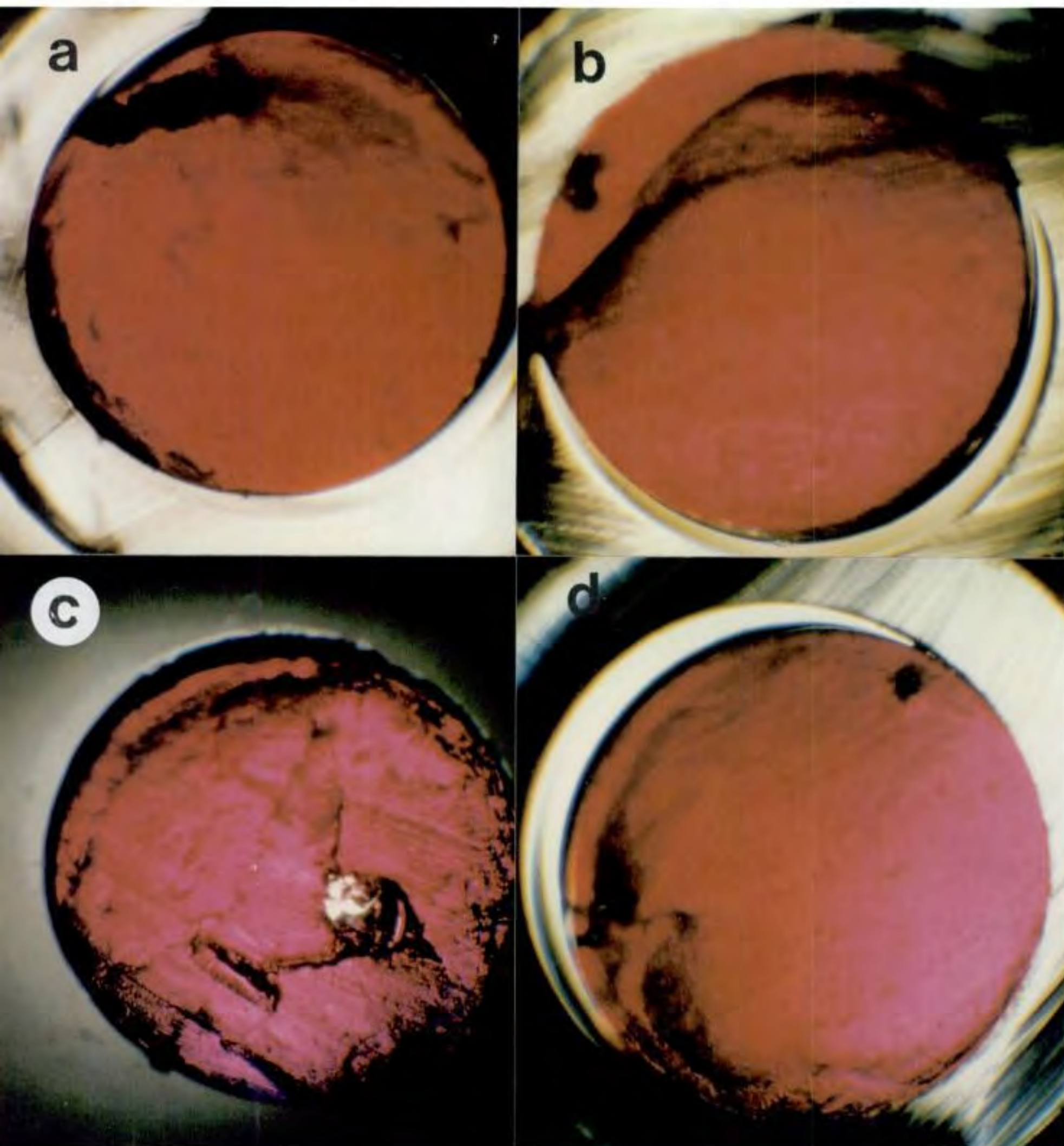


Fig. 16. Production of anodic and cathodic vortices. Electrolysis in a plastic tube between platinum electrodes in litmus-agar-2M KCl water solution at 4 V. Microscopy of 1 mm slices of the transected plastic tube and content show anodic sickle-shaped bright red parts of the anodic vortex (*a-d*) and part of the bluish cathodic vortex (*c* and *d*).

num-iridium threads. The insulating teflon was removed over 5 mm and this part was introduced into each end of the tubing with agar-agar stabilized litmus containing electrolyte.

Electrolysis was started at the application of 0.5 mA, 4 V between the electrodes for 3–5 minutes. The hydrolysis of water then produces anodic H^+ , O_2 and Cl_2 and cathodic OH^- and H_2 gas. The H^+ ions color litmus red. The OH^- ions color litmus blue. The colored material moves partly by diffusion, and partly by the migration, by the anodic and cathodic fields. After interruption of the hydrolysis, thin slices (~1 mm) were cut with a razor blade of the plastic tube and its agar stabilized electrolyte. Fig. 16a–d show photographic views of the red, anodic cuts seen in a microscope from the anodic towards the cathodic end of the tube. The “homogeneous” anodic red material represents migrated and diffused proton-litmus mate-

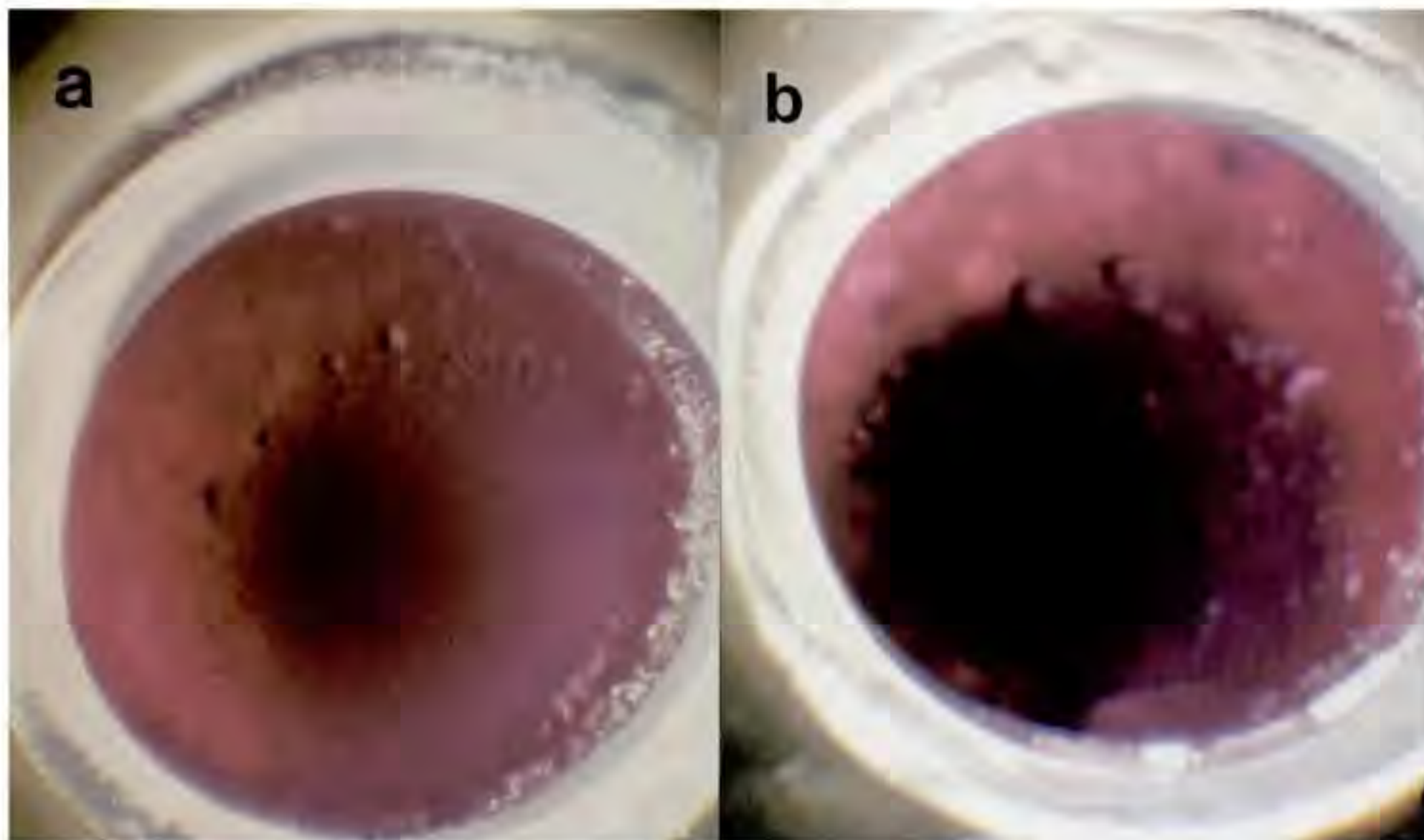


Fig. 17 shows anodic and cathodic material in the mid-part of the 5 cm long plastic tube. In *Fig. 17a* and *b* are seen vorticizing gas-material and in *Fig. 17a* and *b* also light blue cathodic vortex material, which partly even is seen in the wall of the plastic tube.

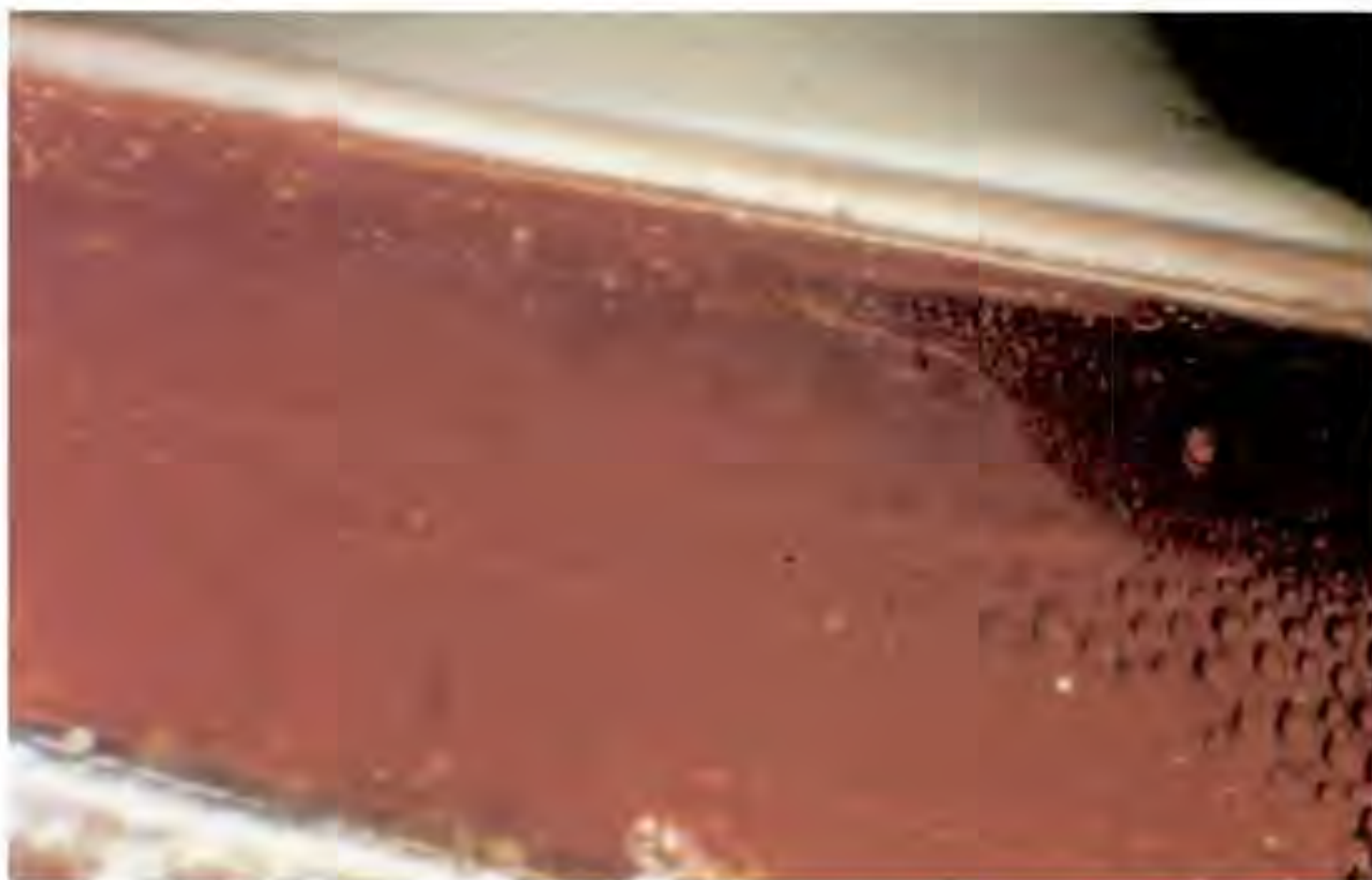


Fig. 18. Side view, direct microscopy showing bright red linear strands deviating from the anode (to the left) towards the wall of the plastic tube. Gas bubbles (O_2 , Cl_2) to the right. Anodic red material by H^+ -litmus migrating and diffusing.

rial and the sickle-shaped bright red portions constitute transected parts of a branch of anodic vortex. Fig. 16d shows part of a bluish cathodic vortex and material which has diffused and migrated from the cathode. Fig. 17a and b illustrate that the blue cathodic vortex has partly even proceeded into the plastic material of the tube. The cathodic vortex is seen in the direction from the cathode towards to anode. It moves in the clockwise direction (same spiralling as the anodic vortex).

Fig. 18 shows two linear expansions of the H^+ litmus (red) close to the anode. They are seen starting to deviate towards the plastic wall. Small gas bubbles, developed at the anodic electrode, are also seen migrating to the right of Fig. 18. The gas bubbles are also seen participating in the vortex formations (Fig. 18).

15. Interferences of Anodic and Cathodic EMFs

It was evident that the red vorteces originating from the anode are rotating in the clockwise direction seen from the anode and the blue vorteces from the cathode are moving in the clockwise direction (seen from the cathode). They are therefore tending to counteract each other when they meet. A maximum of counteraction should occur where two fields are flowing exactly towards each other. A quenching of the fields will destroy the field characteristics leading to new behaviour of previously co-transported materials such as seen in Fig. 14.

16. Central Field-“core”

The central part of the anodic and cathodic vortex flowing towards each other was also studied experimentally.

A glass capillary 1.35 mm wide and 67 mm long was filled with **liquid paraffin**. Platinum string electrodes were inserted into both ends. A 4 V potential was applied between the electrodes. A dipole induction should occur in the paraffin molecules by the field. This could be observed microscopically with a beam of halogen-light arranged horizontally and perpendicularly to the length of the capillary. Between the anodic and cathodic electrodes, centrally in the electrolyte (Fig. 19a) a “core”-like red structure can be observed. In Fig. 19b a white-brown structure can be seen and in Fig. 19c a green-gray similar “core” is also present. Various colors can be seen **at variations of the wave length of the halogen-light**. The “cores” seem to contain straight or slight undulating parallel lengthwise oriented “lines”. These “cores” appear to be developing from the lengthwise positioning of the dielectric paraffin molecules by the applied field between the platinum electrodes. The perpendicular halogen light beam was therefore used to show the altered position of the polarized paraffin molecules by the halogen light. Between the inner surface of the capillary and the outer surface of the “core” a space is seen where no “core” has developed. But in this part of the capillary, a dipole induction in the glass wall interacts with the field which causes lengthwise dipole induction in

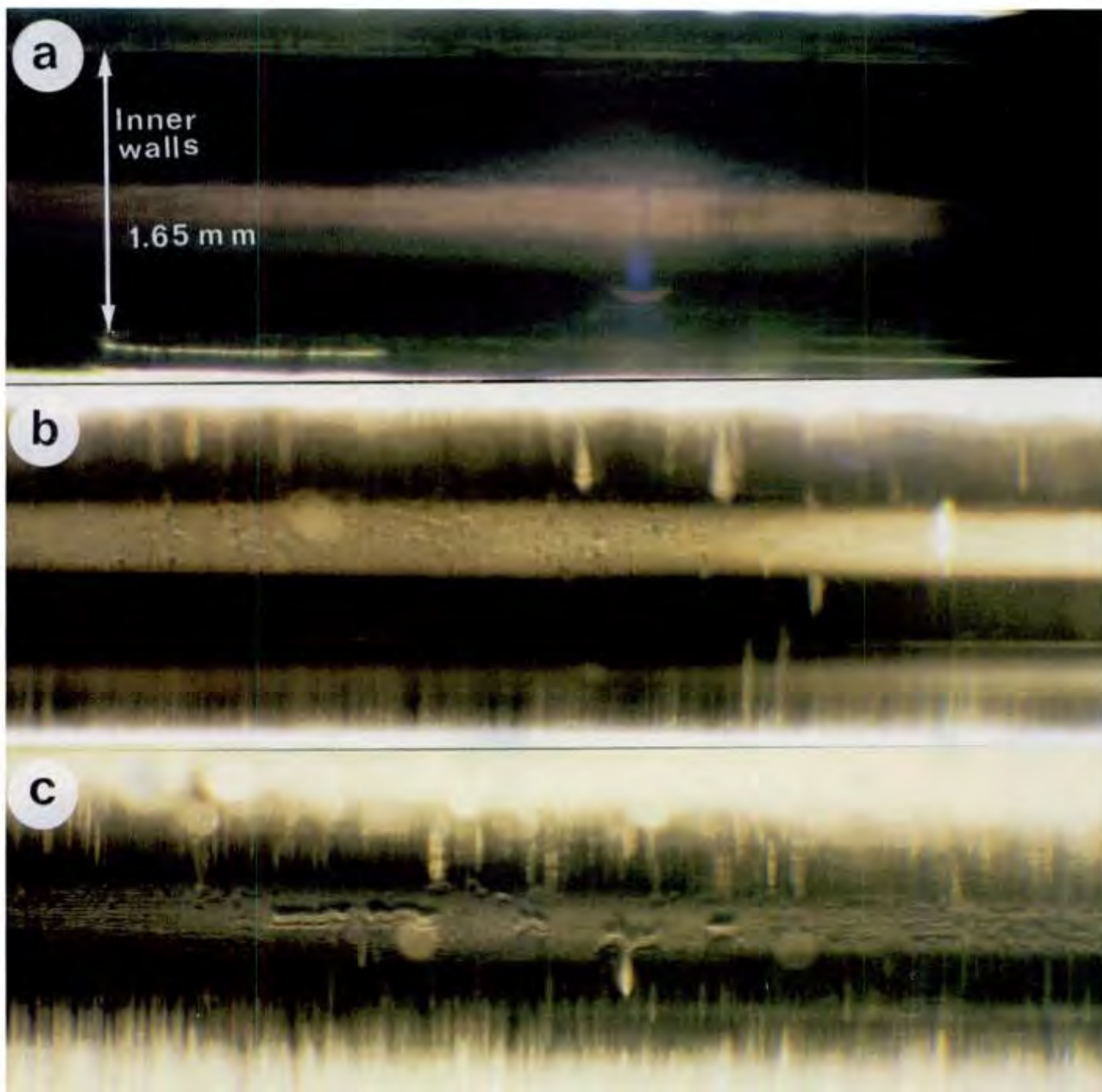


Fig. 19. Macroscopic demonstration of central “core” in liquid paraffin in a 1.65 mm wide and 67 mm long glass capillary. The field applied (4 V) between platinum string electrodes 0.2 mm thick and introduced into the ends of the capillary produce dielectric orientation of the paraffin molecules forming an axillary positioned “field core” between the electrodes. A perpendicularly directed white halogen light beam interacts with the polarized paraffin molecules which results in refraction difference of the “core” centrally in the paraffin. The voltage between the electrodes was not changed. Small variations of the strength of the halogen light gave the different colors of the central “core” (*a, b, c*). The crosswise “hairy” structures (*b* and *c*) are produced by photons with some vortices of the halogen light. Their spirals are only seen diffusely in this low magnification.

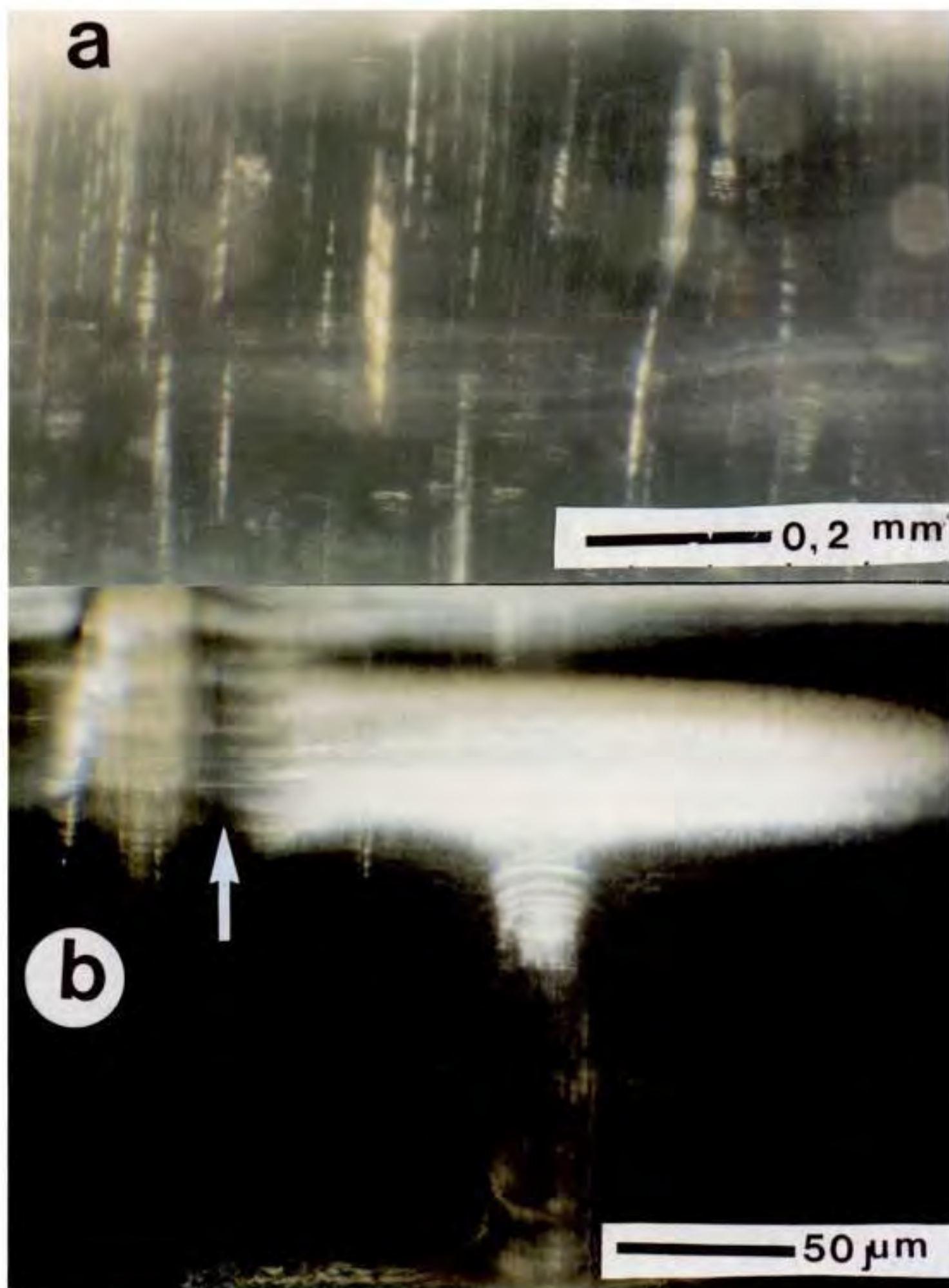


Fig. 20a. At higher magnification of the “hairy” structures of Fig. 19b and c, the spiral structures show photon vortices of the halogen light.

Fig. 20b. One vortex is seen to interfere with the structuring of the liquid paraffin by the interelectrode field. Note the local quenching by the vortex and the interelectrode field (arrow).

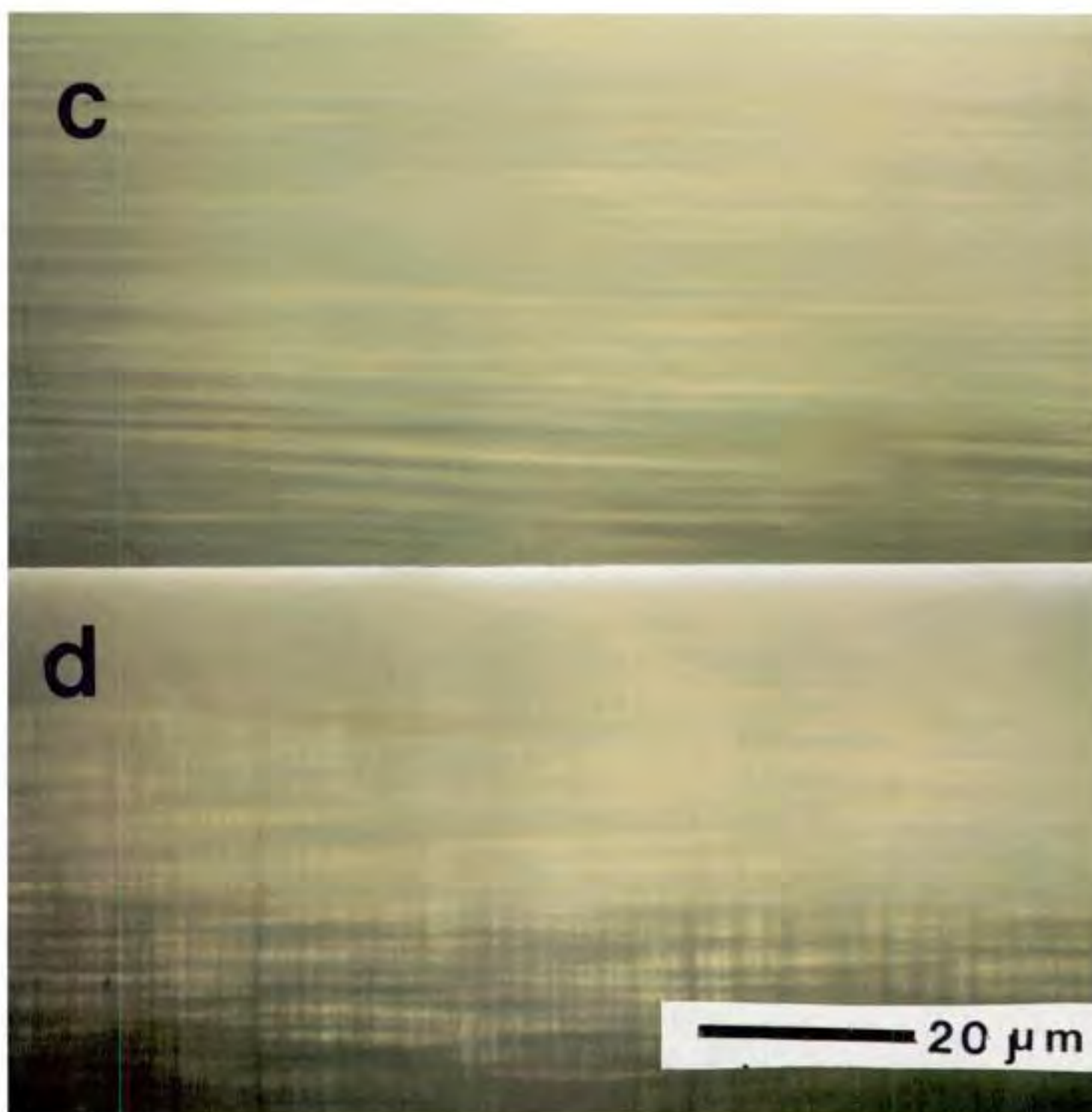


Fig. 20c. The interelectrode field structuring is illuminated from below by the microscopic light shows lengthwise structures.

Fig. 20d. By adding perpendicularly directed halogen light in a layer below the interelectrode structuring (seen in Fig. 19c) it is possible to see a “texture” of superimposed “lines” by appropriate focusing of the microscope light.

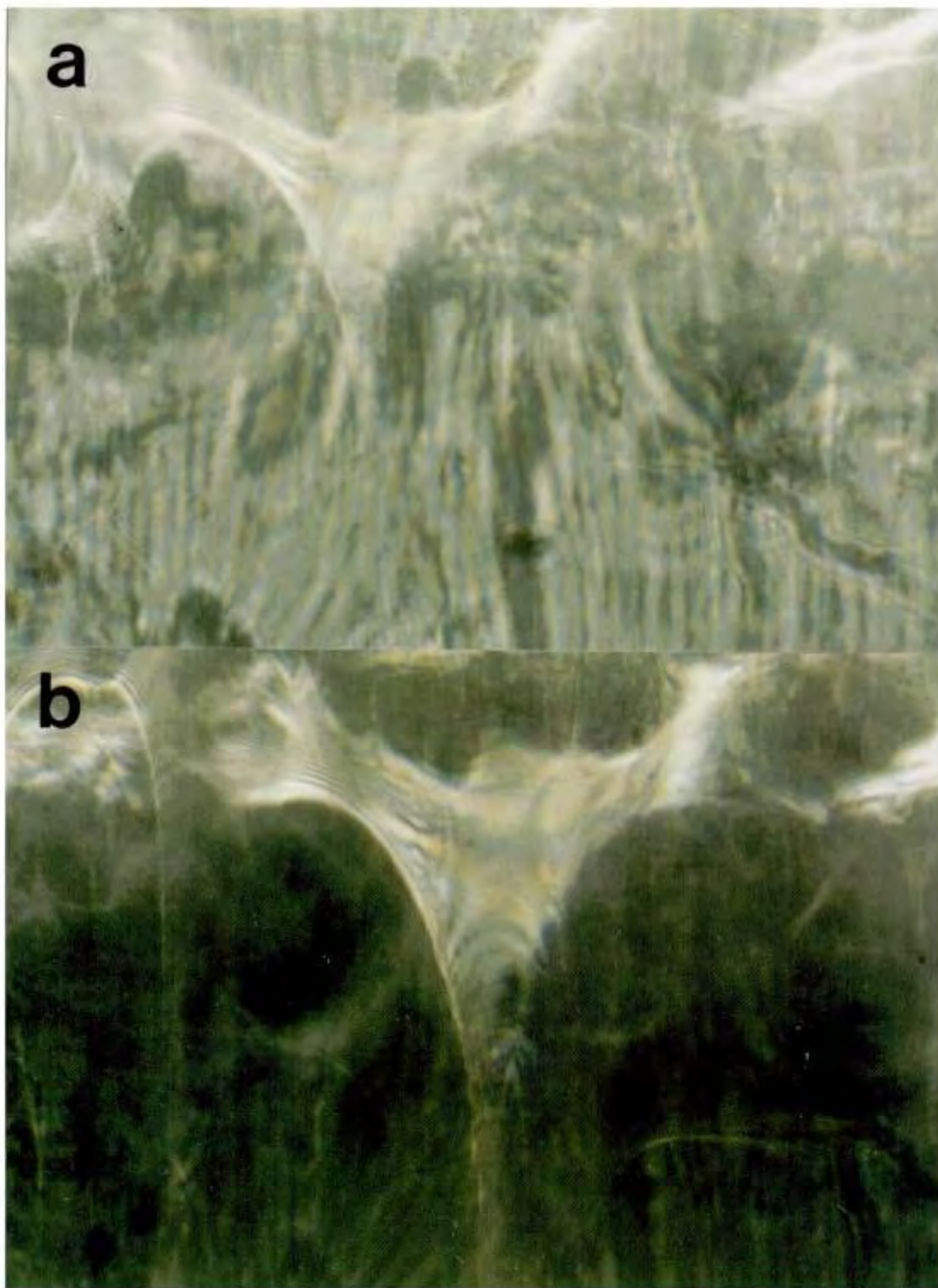


Fig. 21. In new positionings of the halogen lamp it is possible to arrange collision between the fields which leads to CHAOS among the molecules. *a* and *b* represent two focusings of the microscope.

the liquid paraffin. A dipole induction of the paraffin and glass wall of the capillary is then produced also by the EMF of the halogen light.

In Fig. 19b and c are also seen some hairy structures. In larger magnification of the microscope these “lines” are seen to be spirals or vortices of the halogen light (Fig. 20a). At still higher amplification, the spiral structures are clearly seen (Fig. 20b). If we now remove the halogen light and, instead, use the microscope light, a lengthwise smooth structuring of the paraffin can be observed (Fig. 20c). If the halogen light beam now is

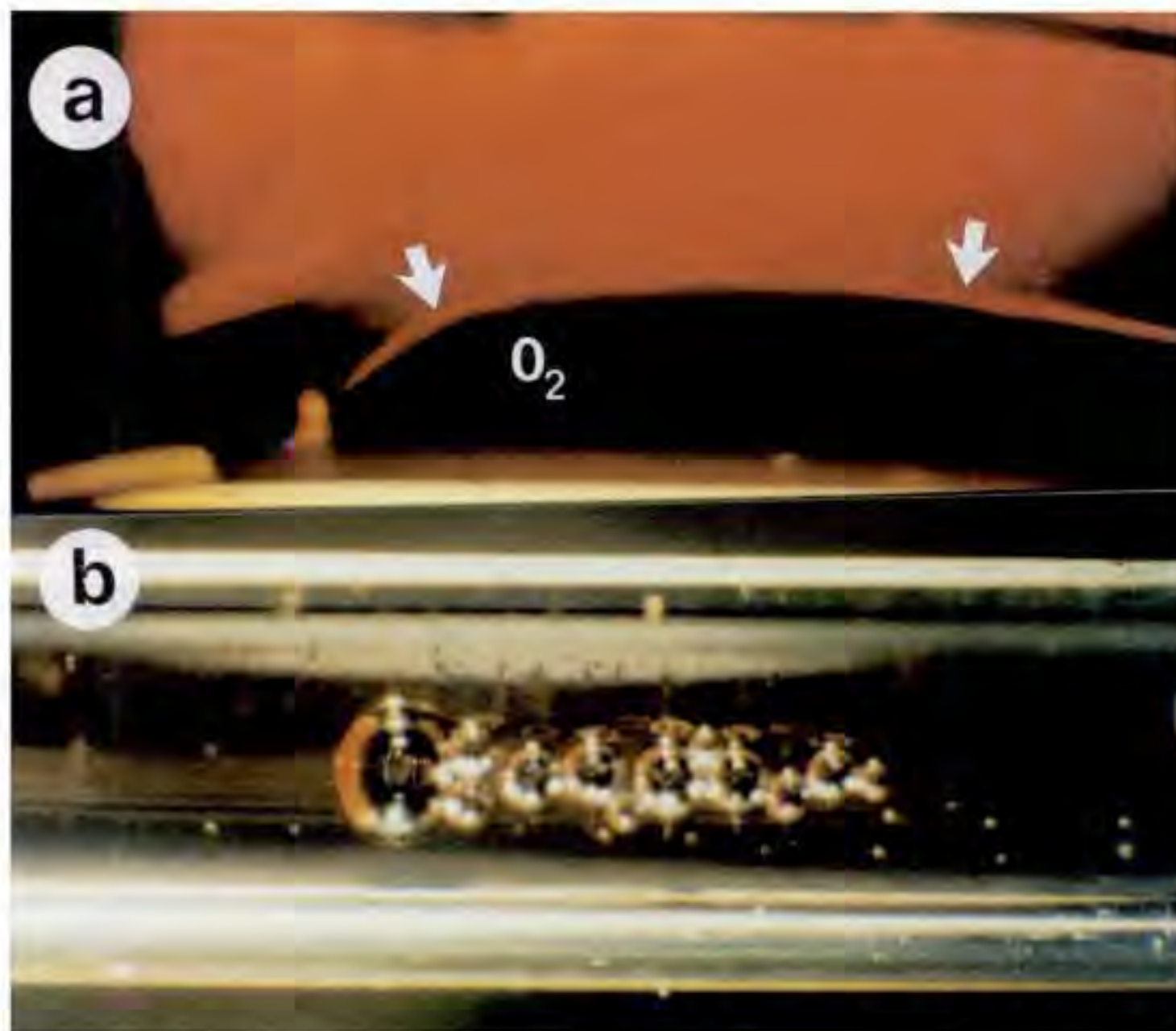


Fig. 22a. Electrophoresis of NaCl-electrolyte with litmus. Electrode products of anodic H^+ and O_2 , Cl_2 . A large gas bubble marked O_2 is adhering to the lower part of the glass capillary. Electrolyte is coloured red by H^+ -litmus. At gas bubble-electrolyte interphase is a bright linear red structure (white arrows) which is interpreted to be a preferential conductive pathway at the dielectric-electrolyte interphase, shown by increased flow of H^+ -litmus.

Fig. 22b shows a central “core” at both sides of some gas bubbles centrally located in the electrolyte (early phase of electrolysis). The largest bubble facing the anodic electrode has got dielectric polarization and attracts with its electronegative side (facing the anode) some red H^+ -litmus.

switched on and directed perpendicularly to a layer of the lower part of the interelectrode field, a texture is seen which looks like a woven fabric (Fig. 20d). We then let these two fields collide by adjusting the height of the capillary in relation to the halogen light beam. This results in an image of **Chaos** among the paraffin molecules (Fig. 21a and b).

At electrophoresis of an electrolyte with litmus, electrode products of anodic H^+ and O_2 , Cl_2 are seen in Fig. 22a. A large bubble marked O_2 is adhering to the lower part of the glass capillary. The electrolyte is coloured red by H^+ -litmus. At the gas-bubble-electrolyte interphase, there is a bright linear red structure (white arrows), which is interpreted to be a **preferential interphasial pathway** for increased flow of H^+ -litmus.

In Fig. 22b a central “core” is evident at both sides of some gas bubbles. The largest one has (by field-induced negative polarity of the surface towards the anode) obtained some local attraction of H^+ -litmus.

17. Proliferation of Matter by Concentration Forces of EMF-transported Particles at Quenching of the EMFs

A glass jar (Fig. 23) was provided with an aluminum layer on its inner wall. An aluminum ball with small protrusions on its surface was glued to the bottom of the jar. The wall foilium and the ball were connected, by cables, to a voltage generator. Liquid paraffin was poured into the jar up to the mid-level of the ball. 1.5 kV were applied between the ball (+) and the foil lining the inner wall of the jar (–). Dielectric semolina grains were sifted evenly onto the surface of the liquid. With light under the jar, five second exposures of photographs were made. Fig. 23a shows an early phase when the grains start to move in the ± 1.5 kV EMF. After a while a structural corona-equilibrium is produced partly influenced by the edge-enhancement effect of the irregular surface of the ball (Fig. 23b).

The protrusions on the ball give edge-enhancement effects with the formation of radiating structures (See Fig. 8a and b showing corresponding in vivo structuring). When more semolina grains are added onto the surface

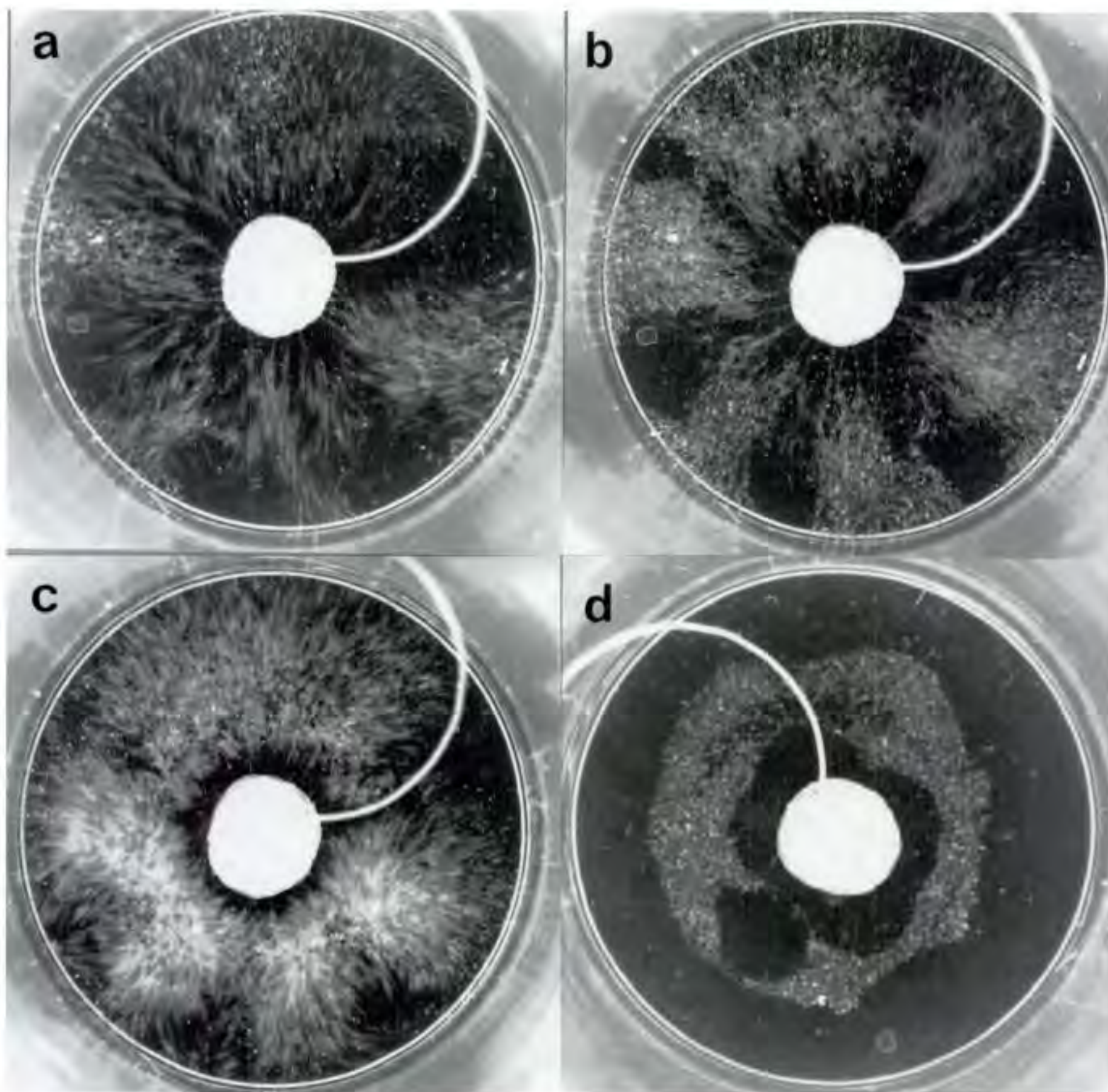


Fig. 23. Glass jar with an aluminum ball glued to the bottom of the jar. The ball has small protrusions on its surface. The inner surface of the jar is lined with aluminum foil. The ball and the wall foil are each provided with a cable. 1.5 V are applied between the two cables. Liquid paraffin is then poured up to the equator of the ball. When semolina grains are strayed onto the surface of the paraffin the grains undergo dipole induction and start to move in the field. 5 second exposure shows the photograph of moving grains (*Fig. 23a*). They obtain later on equilibrium seen in *Fig. 23b*. The protrusions at the surface of the ball give edge-enhancement effects with formation of radiating corona structures. When more semolina grains are evenly strayed onto the liquid paraffin the first stabilized grains attract the new grains by their concentration forces (*Fig. 23c*). At short-circuiting the cables a new equilibrium is obtained showing a ring-shaped structure due to the concentration forces of the grains (*Fig. 23d*).

of the liquid paraffin, the grains that arrive first attract the new ones by their concentration forces (Fig. 23c). By short-circuiting the cables, a ring-shaped structure is formed (Fig. 23d) because of field quenching and the concentration forces of the grains.

18. Electrophoretic Proliferation of Water

The electrophoretic development of an increased concentration of anodic H^+ -litmus and cathodic OH^- -litmus (shown in Fig. 14) is evident by a thin, uncoloured interphase between the red and blue fields. That section is formed by water, which in a microscope shows the flow of uncoloured liquid. This water is formed by field-transported H^+ -ions in the anodic field and OH^- in the cathodic field. They are the most rapidly moving ions. They can move by co-transport of the two fields until they meet almost in the middle of the electrophoretic field. At the field quenching they can recombine into H_2O molecules, which proliferate into clusters of water molecules.

19. The Use of EMF to Obtain Sponginess of Dense Cancers, i.e. Regression of Biological Matter

When cancer cells grow they tend to compress interstitial spaces and blood capillaries. This has been described by Jain ⁽⁵²⁾ as a consequence of the cancer cells' loss of contact recognition. Spontaneous necroses will develop and chemotherapeutic agents will not reach the interior dense part of the cancer.

By applying slowly alternating quasistatic¹ electric fields ($\pm 2\,000$ to $3\,000$ V) between capacitors applied to the body surface outside a cancer, charged particles and cells of the cancer will be displaced or pushed and pulled⁽³⁷⁾. This will make the dense cancer spongy or less dense and thereby become treatable at the use of a chemotherapeutic agent.

20. An Instrument for High Voltage Treatment^{2, 3}

This instrument (Fig. 24) is driven by a 12 V, rechargeable lead battery. The current first passes a chopper. The chopped AC signal is fed into a primary coil of a transformer. Current and voltage of the primary coil are set by two knobs on the front panel. The current of the primary coil induces a voltage increase in a secondary coil (by a factor of $\times 100$) and a current decrease (by a factor of 0.1). The transformed current-voltage (up to 3000 V) is then converted to DC and is passed, via a variable resistor, to the $\pm$ patient terminals. To these are connected specially made capacitors (described below). The variable resistor is always turned to maximum before current is allowed to charge up the capacitors. After setting the desired voltage by a turnable knob (e.g. 2 000 V) the flow of current to the capacitors is increased by lowering the variable resistor function and adjusting the voltage. In this way a current spike to the capacitors is avoided, which could damage the instrument. The flow of current can, in this way, be maximized. The flow of current is a relative measure of the current utilized to charge up the capacitors.

The red button "Discharge" short-circuits the two $\pm$ patient terminals. Do not push this button when the voltmeter shows a voltage load. The instrument can in this case be damaged. Turn first down the voltage to zero. The instrument is only intended to be used with capacitors connected to the patient terminals.

¹ This means that the changing of polarity of the capacitors induce displacement of charged particles (i.e. induce displacement current).

² Patent Pending.

³ Manufactured by Christer Asp, Aspens, Falköping, Sweden.



Fig. 24. The high voltage treatment apparatus with its rechargeable lead battery.

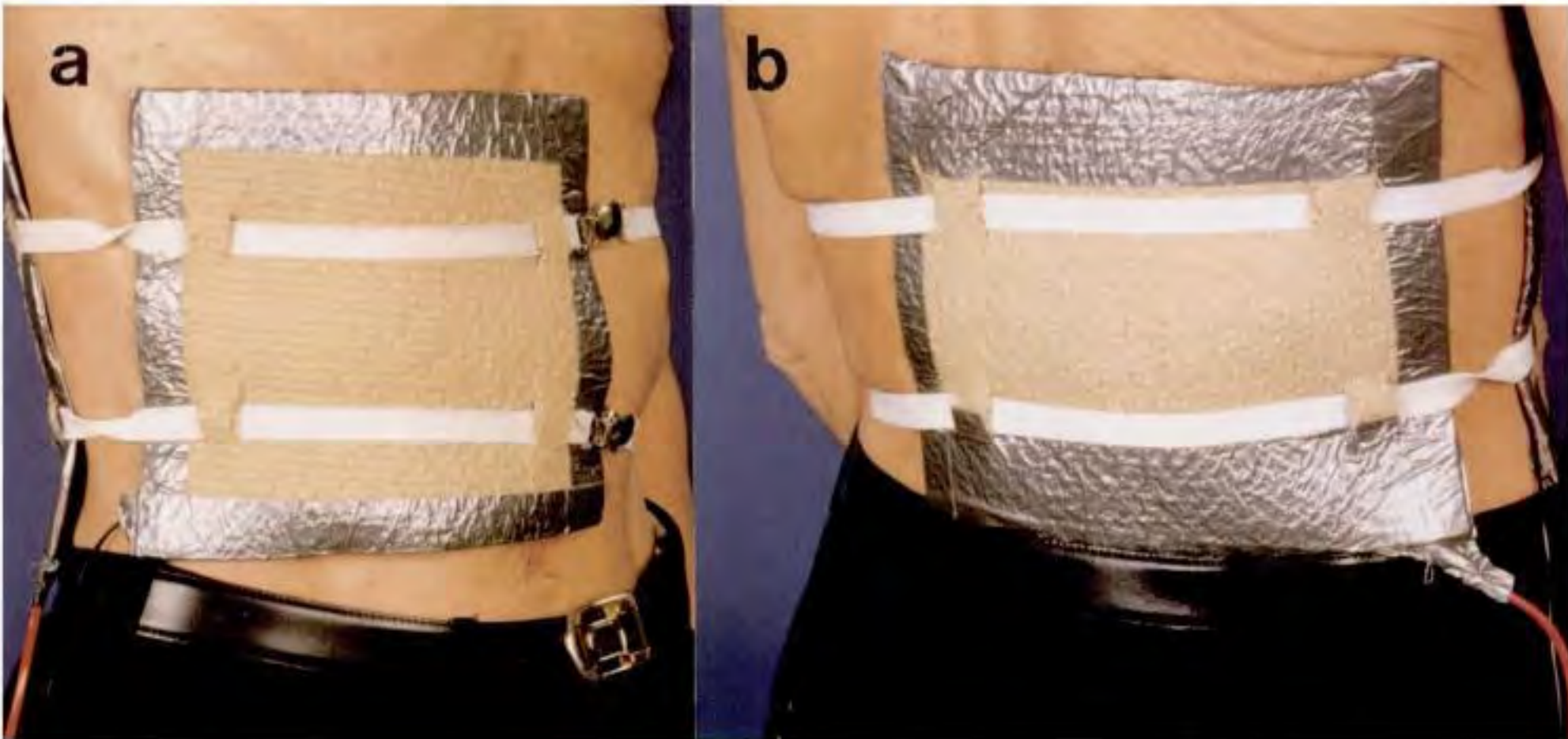


Fig. 25 shows one anterior capacitor (a) and one posterior capacitor (b) applied with rubber straps to the body for treatment of a liver cancer.

The capacitors (Fig. 25) are constructed in a way so that they can be applied to the body surface with one anodic and one cathodic capacitor charged from the negative terminal and one from the positive patient terminal. They each have a stack of 10 aluminum foils connected to insulated separate cables. The aluminum foils are enclosed in an insulating dielectric material. This has to be carefully sealed by the use of e.g. silicon glue to prevent an excessive leakage of current through the capacitors which are placed in contact with the skin surface of the patient. The treatment instrument and battery can be carried in a bag by the patient (Fig. 26) who therefore can move around without being bedridden.

All capacitors leak to some extent. To ensure that the capacitors are safe to use they must be tested. One anodic and one cathodic capacitor is im-



Fig. 26. The patient with applied body surface capacitors can move around during treatment, carrying the high voltage instrument and the battery in a bag.

mersed in saline solution and 3 000 V are applied between them. The recorded flow of current shown by the mA meter is not allowed to exceed the scale of the instrument. If so is not the case the insulation of the capacitors must be improved. The displacement current to fill up the capacitors applied to the skin surface of the patient normally shows a temporary peak of 10–20 mA and then stabilizes around 5 mA. An excess flow, e.g. 10 mA, is caused by the normal, “external” leak of displacement current in the tissue between the capacitors. This flow is influenced by e.g. production of sweat from the skin under the capacitors which makes the mA-meter to show an additional 10 mA (= a total of 25 mA).

21. Use of EMF to Obtain Sponginess in Dense Malignant Tumors

A 64 year old prominent French biochemist fell ill in signs of a right lower lobe pleuropneumonia April 3rd, 1995 (Fig. 27a). He received antibiotics. After two weeks, the pneumonia had been successfully treated, but a large tumor was seen to grow around the bronchus in the right lower lobe (Fig. 27b). Bronchoscopy with biopsy revealed a primary low differentiated small cell carcinoma with metastases in the mediastinum. The patient asked himself for High Voltage Fluctuation Field Chemotherapy treatment as he was aware of this procedure. One anterior and one posterior 14×14 cm large capacitor were made for the patient. They were applied onto the anterior and posterior chest wall over the tumor and secured with straps to the chest. The capacitors were charged ± 2600 V in relation to each other and their polarity was changed every 3rd hour (except for 8 hours in the night). The maximum current flow between the capacitors was 10 microamperes. This HVFF Chemotherapy treatment continued one week during i.v. infusion of chemotherapy (Endoxan 1900 mg, Adriamycin 90 mg and Oncovin 2 mg (= one cycle)). A total of 6 cycles were given; one cycle per week. The charging of the capacitors was done only during the first week. The patient tolerated the treatment well. After the first 4 cycles (April 13–

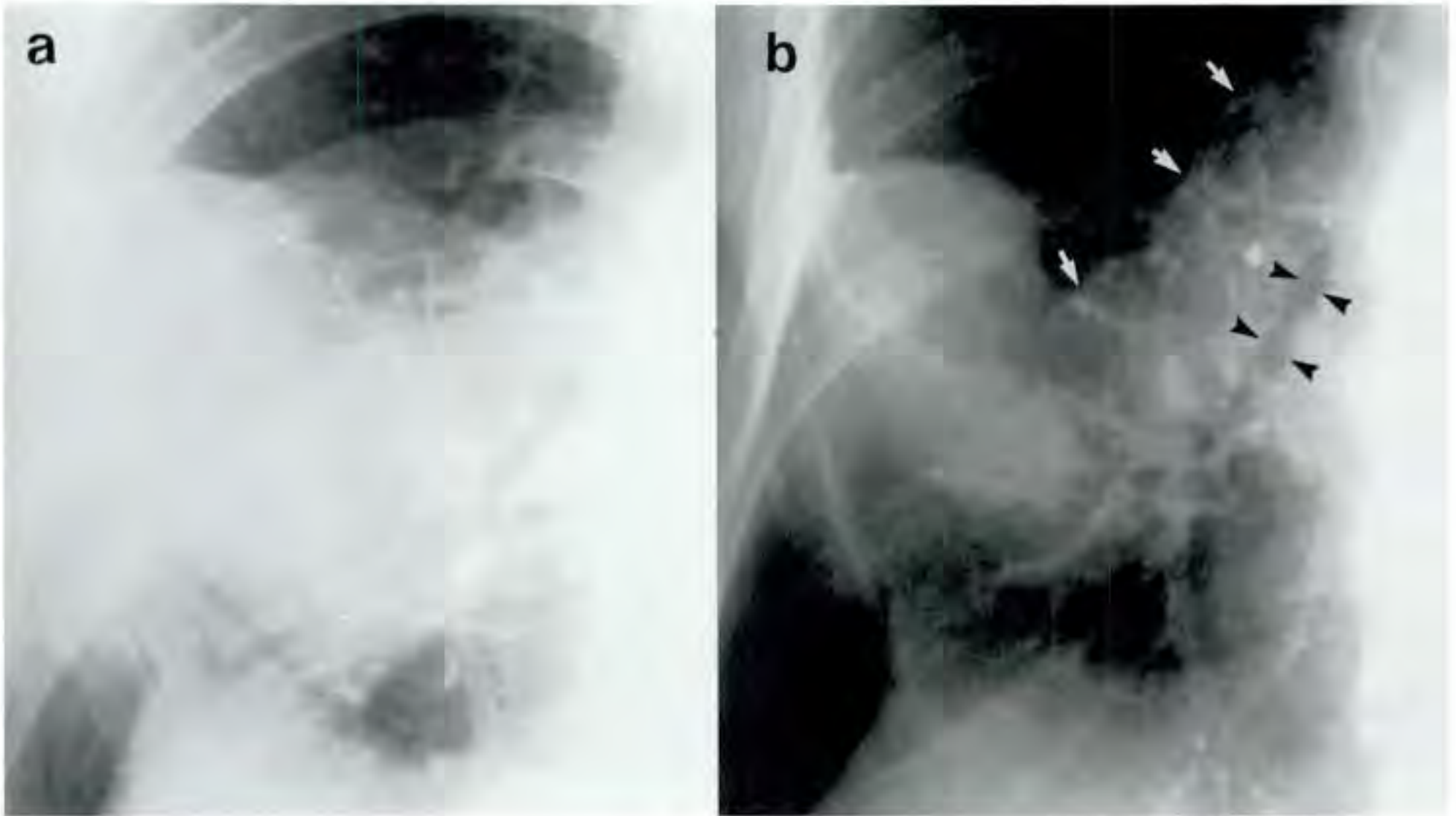


Fig. 27a. Right-sided pleuropneumonia in a male, 64 years old.

Fig. 27b. After treatment with penicillin the pleuropneumonia has almost disappeared in two weeks. A large small cell carcinoma (white arrowheads) remains around the right lower lobe bronchus, irregularly narrowed (black arrowheads).

May 10) the lower lobe tumor had almost disappeared (Fig. 27c). At that time a dense spherical infiltration was seen as a residual “fibroma” in the pleura after the pleuropneumonia. Some additional cycles of chemotherapy, without High Voltage Treatment, were then given and the radiograph of the chest 3 months later showed still no cancer growth but still a pleural reaction (Fig. 27d).

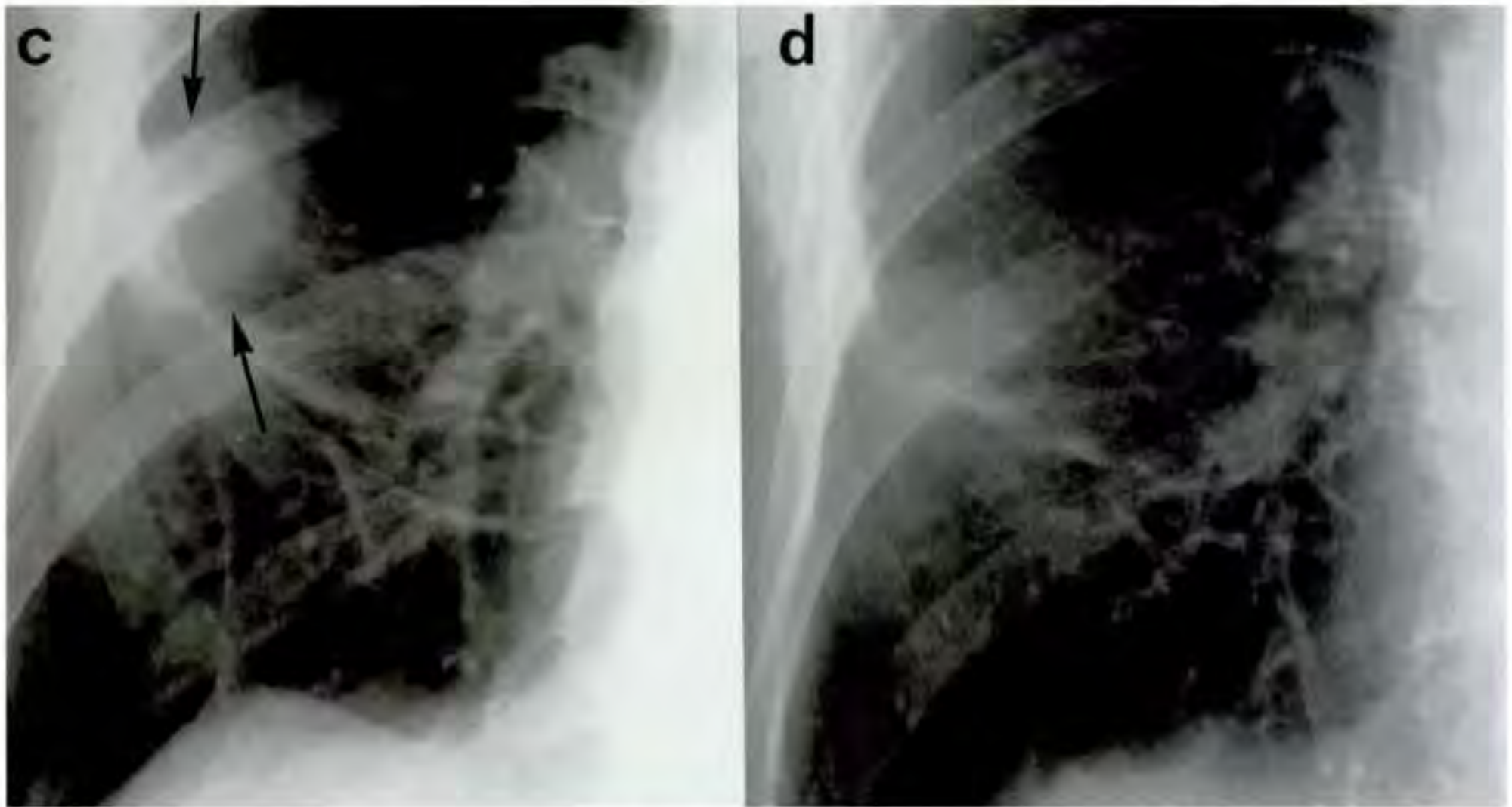


Fig. 27c. Start of High Voltage (2600 V) Treatment Charging of capacitors applied to the anterior and posterior chest wall over the cancer. The polarity of the capacitors was changed every 3 hours (at 6, 9, 12, 15, 18 o'clock). Voltage difference unchanged during night. This treatment continued one week to make the cancer "**spongy**" e.g. allowing simultaneously given **chemo-therapy** agents to act also in the interior of the cancer. After 27 days the cancer has almost disappeared. Remaining benign pleural density ("pleuroma") from the pleuropneumonia (arrows).
Fig. 27d. Three months later. No cancer in the right lung. The residual pleural density is still visible but less prominent.

22. High Voltage Fluctuating Field (HVFF)

The reported treatment illustrated in Fig. 27a–d is performed using high voltage quasielectrostatic fields in connection with infusion of chemotherapeutic agents. The alternating $\pm 2\ 600$ V electromagnetic field is applied to produce displacement of ions and charged movable cells in the tissue, including the cancer between the capacitors. The intention is to, first, obtain “sponginess” to the cancer tissue. This should give the simultaneously administered chemotherapeutic agents a chance to reach the deepest parts of the cancer. Secondly, we want to influence on the concentration of the chemotherapeutic agent in the cancer tissue. Depending on polarity of the agent, the positive or negative field will contribute to the increase of the chemotherapeutic agent in the cancer. Similarly a field effect will have an influence on immunologic factors.

There are mechanisms in EchT and HVFF-chemotherapy which are common. One factor is the EMF applied. In electrochemical treatment (EchT) it has often been found that small metastatic cancers located within the electrical field can disappear in regions where products of electrode reactions could not have produced the regression. In such cases the best explanation is that there has been an effect of the applied field. Other evidence of field effects in EchT may be tied to the local complete disappearance of a cancer where no residual changes are produced at the former place of the cancer.

Such a case is shown in Fig. 28. An old woman, operated for a breast cancer later acquired a metastasis to the middle lobe (Fig. 28a). One platinum electrode was introduced percutaneously (with local anaesthesia) and placed in the center of the tumor. Another platinum electrode was placed in the lung 1 cm above the cancer. With the tumor electrode anodic 10 V were applied and a total of 160 coulombs were given. The electrodes were removed and the cancer gradually regressed over some months and disappeared completely without even leaving a scar in the lung (Fig. 28b). Usually a granuloma or scar tissue will be seen after a successful EchT of a cancer. The reason for the good effect should be explored as there is evidently a possibility to improve the electrochemical treatments (EchT). The rapid and complete disappearance of cancers at HVFF and EchT may require an analysis of the EMF itself.

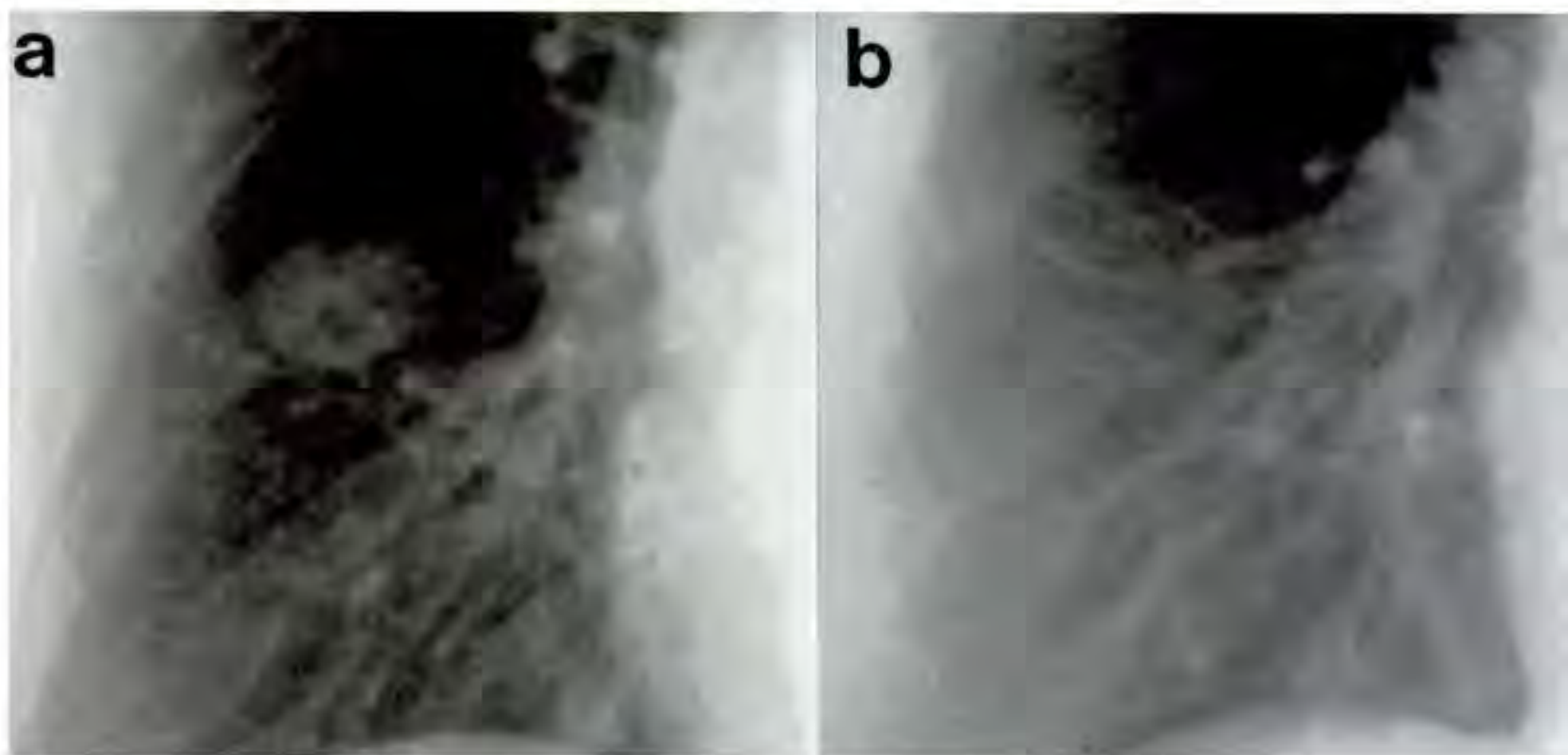


Fig. 28. Breast cancer metastasis to the right lung of an old woman not eligible to be treated with surgery. One small platinum electrode was inserted in local anaesthesia into the center of the cancer (+) and one into the lung (-) 1 cm above the tumor. Electrochemical treatment (EchT) with 160 coulombs of DC were given between the electrodes at 10 V. (a) Before treatment, (b) Still after four years no cancer is present in the lung. No scar tissue has developed.

23. Regressions and Proliferations in Spontaneously Developing Cancers

The spontaneous development of **corona structures** (Fig. 8a+b) in the lung in man and dog was found to be the result of a spontaneous injury polarization of the cancer inducing ionic flow between polarizing tissue components (1, pp. 1-37). The development of corona structures is, therefore, an indication of Nature's own tendency to modify ("**to heal**") the cancer.

The effect of in vitro stimulation of akaryotic cells has been demonstrated by O'Clock and Lyte who succeeded in suppressing malignant cells using low-level direct currents (55, 56).

Spontaneous necrosis is known to occur in malignant tumors. This process produces energy which can be associated with a voltage gradient between the necrotizing tumor and surrounding, non-injured tissue ^(1, pp. 69–78). The polarization occurs spontaneously in various tissues irrespective of the origin of injury (e.g. incision, crush injury, infectious injuries, heat, chemical injury etc). By the use of electrodes, current can be produced in closed circuits between tissues, powered by an external source of electrical energy. As a result, both destruction (**regression**) will take place by e.g. toxic electrode-electrolyte reaction products and **proliferation** by formation of anodic and cathodic fibrous tissues. Anodic acidity and cathodic base material from hydrolysis of water also produces **regression** of hemoglobin, which changes into acidic and base hematin. Certain regressions can be looked upon as matter in proliferation. In this case, the initial phase of blood destruction is very useful. Its free energy is utilized for “building” or proliferating material. Regression leading to liberation of energy (one functional meaning of metabolism) may therefore subsequently lead to functional proliferation and then regression.

24. Participation of the EMF in Proliferation and Regression of Cells and Tissue

Fig. 29 illustrates how interferences associated with the magnetic components of EMFs can produce proliferations and regressions in tissues and cells. The anodic and cathodic fields extending around the flow of positive and negative currents in Fig. 29 lead to a maximum of enhancement of the magnetic fields between the currents ($h \rightarrow \max$). This in turn prevents the contact reactions between the co-transported particles, which should lead to **regression**. In other regions a minimum of magnetic field-influence is produced by counteraction of the fields ($h \rightarrow 0$). This produces an increase in particles. The particles can interact by their own forces which leads to **proliferation**. In Fig. 29 zero means quenched fields.

We have already shown something of what may happen in electrophoresis (Fig. 14). By EMF-co-transport of anodic H^+ and H^+ -litmus (red reaction) and cathodic OH^- and OH^- -litmus (blue reaction), an increased con-

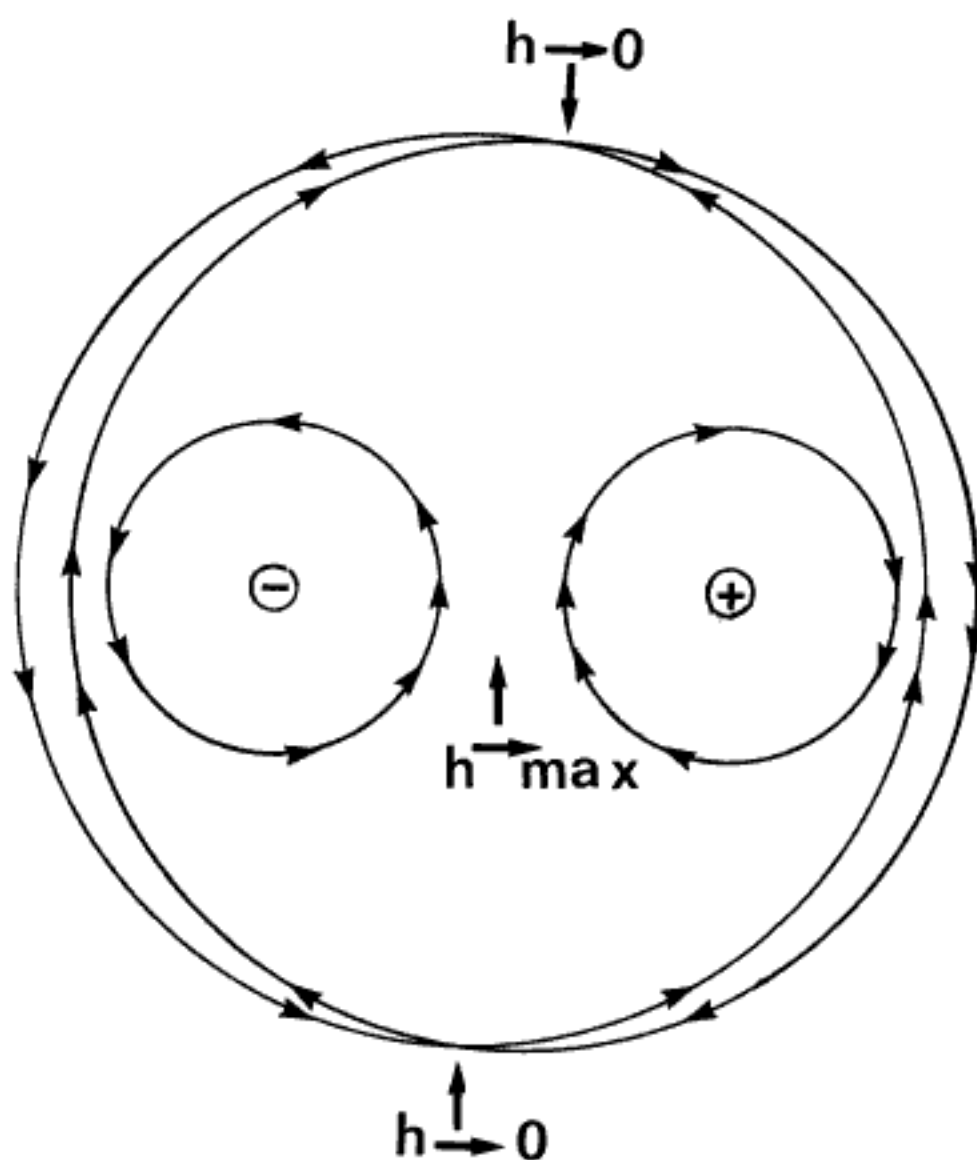


Fig. 29. Interaction of anodic and cathodic EM-fields presenting regions of maximal magnetic effects ($h \rightarrow \max$) and regions of decreased, or even quenched, magnetic effects ($h \rightarrow 0$). The anodic field (+) is flowing in the direction from the observer and the cathodic towards the observer.

centration of anodic red and cathodic blue materials are produced. As the particles become physically closer and more concentrated, at field quenching, this leads to interaction of the particles leading to **proliferation**.

In fig. 23 was shown that semolina grains sifted onto the surface of liquid paraffin, and exposed to a strong field gradient, forces the dielectric grains to move. The grains seek a phase of equilibrium with the edge enhancement forces at the protrusions of the irregular surface of the aluminum ball, which leads to radiating structures, i.e. a phase of **proliferation**. By grounding the terminals, the fields are quenched, and this leads to a led to strong condensation of the grains by their own concentration forces (a new phase of **proliferation**). These interactions were also studied in blood and tissue cells. A series of studies have been made with electrophoresis of normal human CPD-adenin blood with the intention to find morphological changes indicating the possible presence of proliferations and regressions.

25. Regressions and Proliferations of Human CPD-adenin Blood

The model in Fig. 14 was used to study electrophoresis of human CPD-adenin blood. Platinum-iridium electrodes 15 mm long, 0.2 mm thick were placed in parallel on microscopic slides with an internal distance of 20 mm from each other in a layer of CPD-adenin blood. 6 V, 5 mA, 0.15 coulombs were applied to the wet blood. Samples were then taken (1) close to the electrodes, (2) in the mid-part, and (3) in the distal part of each field. The samples were smeared onto new glass slides, were dried and stained with hematoxylin-eosin and examined microscopically. Fig. 30 and 31 show cells from the anodic field marked (+) and Fig. 32, 33 and 34 cells from the cathodic field marked (–).

Samples from distal part of the field are marked (1).

Samples from mid-part of the field are marked (2).

Samples from the vicinity of the electrode are marked (3).

Anodic samples

Fig. 29a–d show blood from the anodic field (1).

In fig. 30a, the upper part shows some rather normal looking red blood cells. In the mid-part of this figure (2), the cells show a dark spot (possibly hematin) and some “vacuoles”. Both changes may indicate an **early regression (or early phase of proliferation)**.

Fig. 30b shows blood cells from the anodic, mid-part (2) of the blood specimen with enlarged red blood cells, granulated cytoplasm and large “vacuoles”. Advanced **changes of regression** or proliferation of “vacuoles”?

Fig. 30c and d show anodic blood from the vicinity of the electrode (3). Large amounts of destroyed **regressive blood** can be seen along with spot-like accumulation of the destroyed material which accumulates around central “holes” partly surrounded by a membrane-like structure (Fig. 30d = enlarged view of concentrated destroyed blood). **Proliferation of destroyed, regressive blood?**

Fig. 31a–d. (a) Anodic blood, sample from the distal field (1) shows centrally located pigments and some vacuoles. Indicating **regression?** and

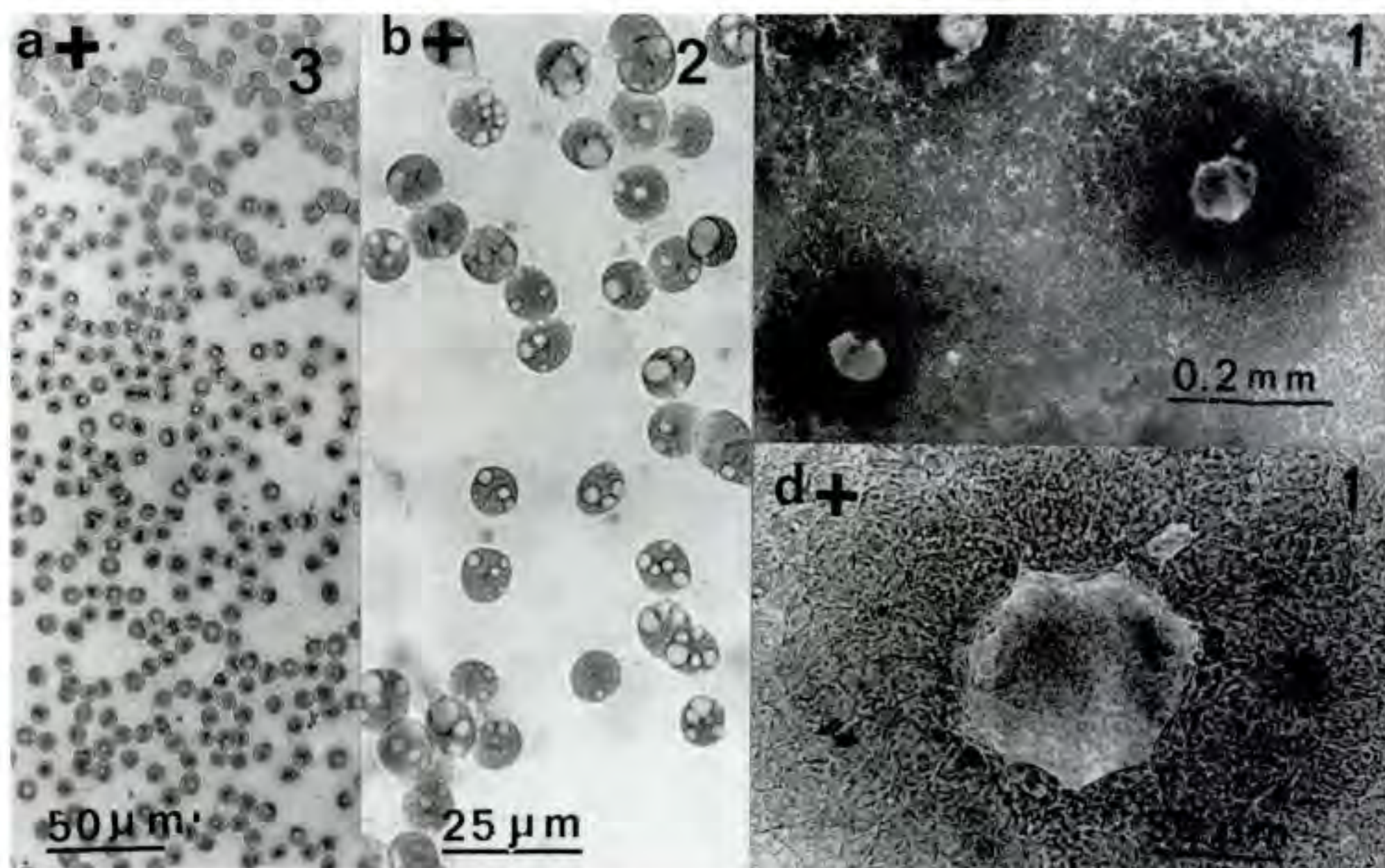


Fig. 30. Transformation of red blood cells at 6 V, 5mA, 0.15 coulomb.

Samplings

Anodic sample (+): Sample from distal field (3)

Cathodic sample (-): Sample from midpart of the field (2)

Sample from vicinity of electrode (1)

Samples of red blood were collected (a) from the distal part (3) of the anodic field. Some normal looking cells in the upper part of the sample. Mostly dark accumulation of probable blood pigment in the central parts of the cells. Some cells have a central clear zone inside. Possibly regressive changes.

Fig. 30b. Anodic blood, mid-part (2). Most cells are large and have inside several vacuole-like changes. Cytoplasm granulated. These may represent regressive changes but might also indicate proliferations.

Fig. 30c. Anodic blood from the vicinity of the electrode (1). The blood appears to be highly degraded. Collections of blood material around a central "hole" may indicate phase of proliferation of highly regressed blood.

Fig. 30d. Enlargement of the specimen from Fig. 27c shows a "hole" which has "walls" and some material in the center. Surrounding material may consist of blood cells which have lost their hemoglobin.

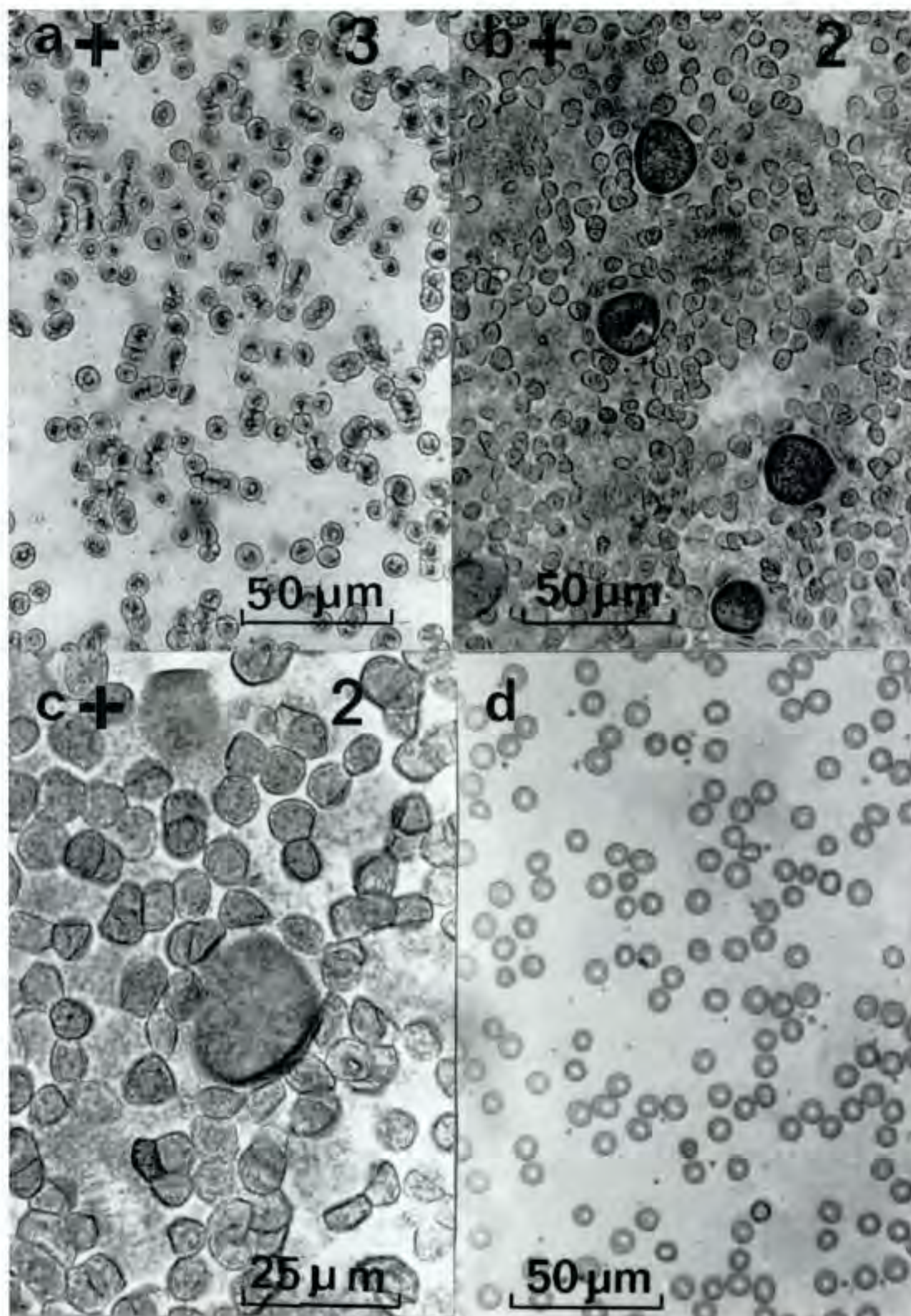


Fig. 31. Anodic blood. (a) Sample from the distal part (3) of the anodic field. Blood cells have an accumulation of hematin centrally. Some cells seem to have attracted to each other or show small vacuoles. (b) Mid-part (2), anodic field. The red blood cells are small and have reduced amount of pigment. Scattered large "cells" of blood pigment surrounded by a membrane-like structure. (c) Enlarged section of Fig. b. Some granulation is seen in cytoplasm of the red blood cells. (d) For comparison non-treated blood sample.

tendency of cellular attraction, forming short links of cells. **Proliferation?**

Fig. 31b. From mid-part of anodic field (2). Rather empty cells with fragments of granulae. **Regression?** and large cell-like structures with granulation and “capsule”. **Proliferation?**

Fig. 31c. Enlarged part of Fig. b.

Fig. 31d. Non-treated red blood cells for comparison.

Cathodic samples

Fig. 32a–c show cathodic blood. (a) From the peripheral cathodic field (1). Central location of hematin in enlarged red blood cells forming rows and flakes of attracting cells. **Proliferation?**

Fig. 32b. Sample from mid-part of cathodic field (2). Enlarged leukocytes can be seen along with empty red blood cells forming “folds” of the cellular membrane. **Regression?**

Fig. 32c. Sample from the vicinity of the cathodic electrode (3). Highly destructed red blood cells (= **regression**). Some of the cellular material accumulates around a central “hole”, possibly a kind of **proliferation**.

Fig. 33a–d are all samples from mid-part (2) of the cathodic field. (a) shows many dark red blood cells with birefringent particles and vacuoles (**regression?**).

Fig. 33b. Also from (2) showing the birefringency of (a).

Fig. 33c. Other parts of cells from (2) show enlargement of red blood cells, sickle-cells, birefringency and vacuoles (**regression?**).

Fig. 33d. Other parts of cathodic (2) field showing dark red blood cells, crenations, birefringency. Possibly also showing **regressions**.

Fig. 34a and b. Samples from mid-part (2) of cathodic field. (a) shows empty small blood cells and some enlarged “cells” which may represent fused small cells. The large cells have a fold-like structure. Conglomerations of these form a “tissue”-like structure (Fig. 34b).

It is extremely difficult to decide if regressive or proliferative differentiations have developed. By applying weak current to blood, various morphological changes appear in the red blood cells both in the anodic and cathodic fields. These changes must probably be followed over a very long time in attempts to decide whether regression or proliferation is going on.

However, it is possible to observe that weak current passing through organized tissue can lead to recognizable proliferation as well as regression.

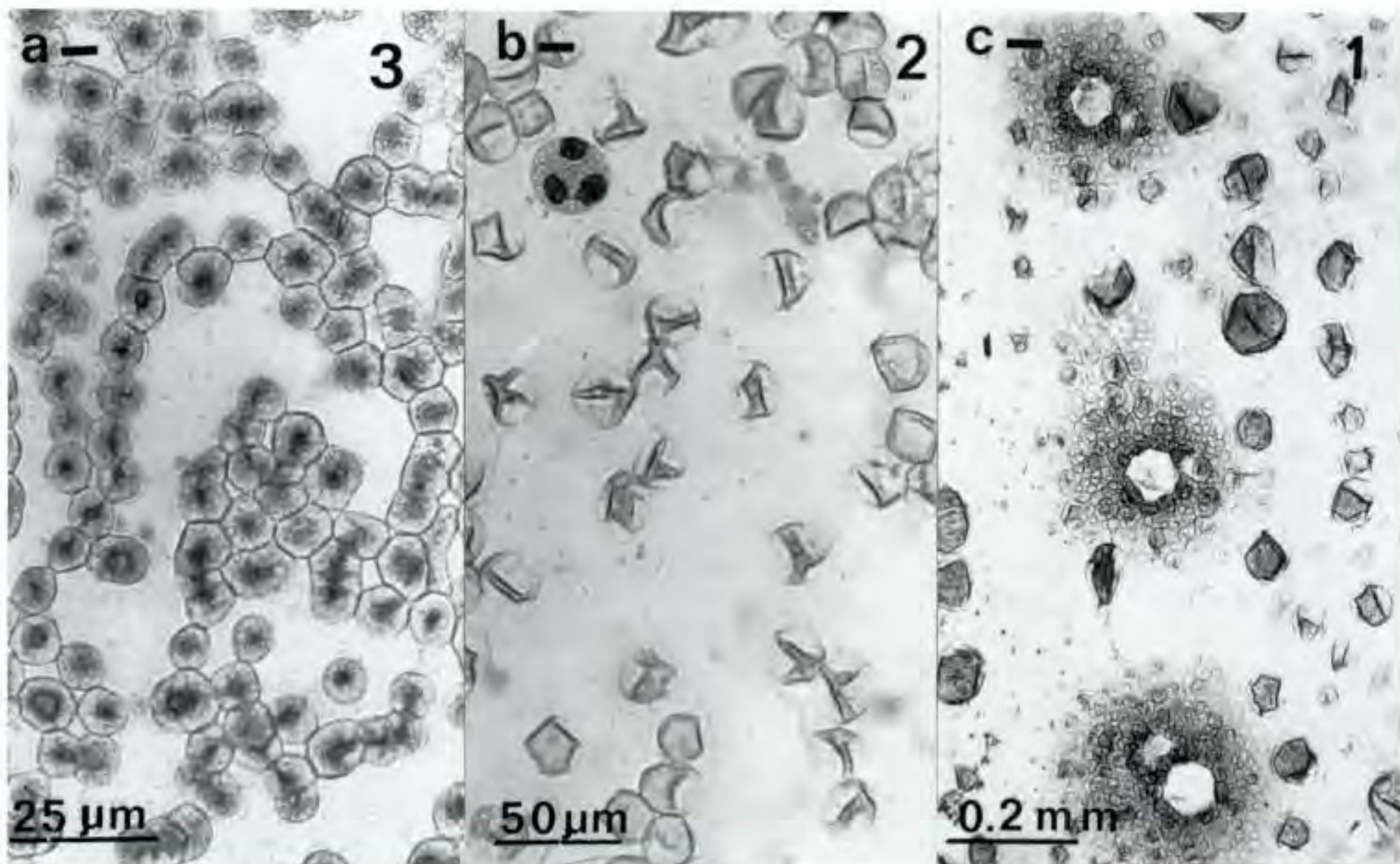


Fig. 32. Cathodic blood samples. (a) From distal part (3) of the cathodic field. The blood pigment is concentrated in the center of the blood cells. These partly attract to each other forming chains or flakes. (b) From mid-part (2) of the cathodic field. The cells have lost their hemoglobin but are large and show fold-like changes. (c) Sample from the vicinity of the cathode (1). Highly destructed cells of various size. The larger show "folds". Small cells without hemoglobin are accumulated in spot-like structures around a central hole. Suggested proliferation of regressed blood material.

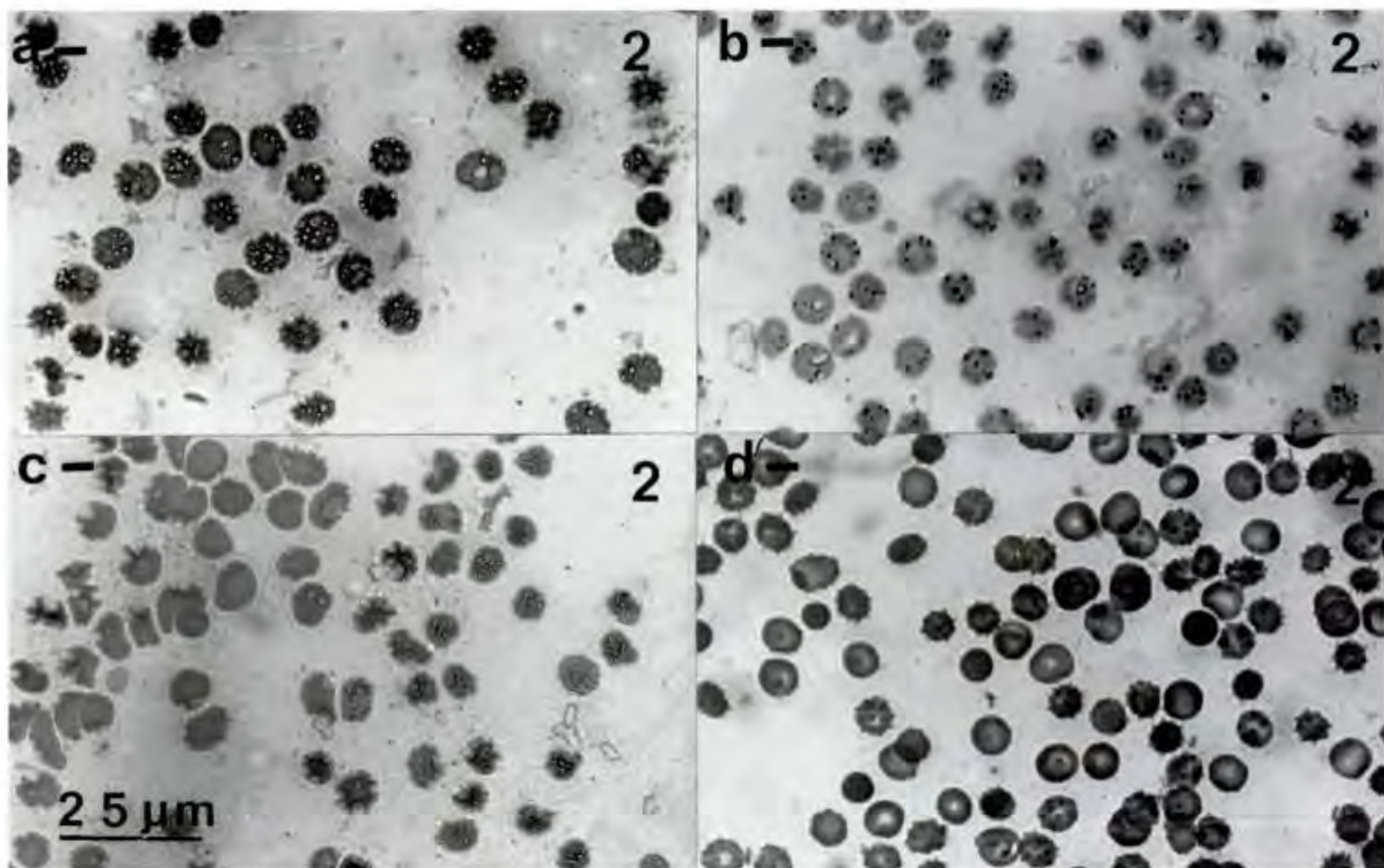
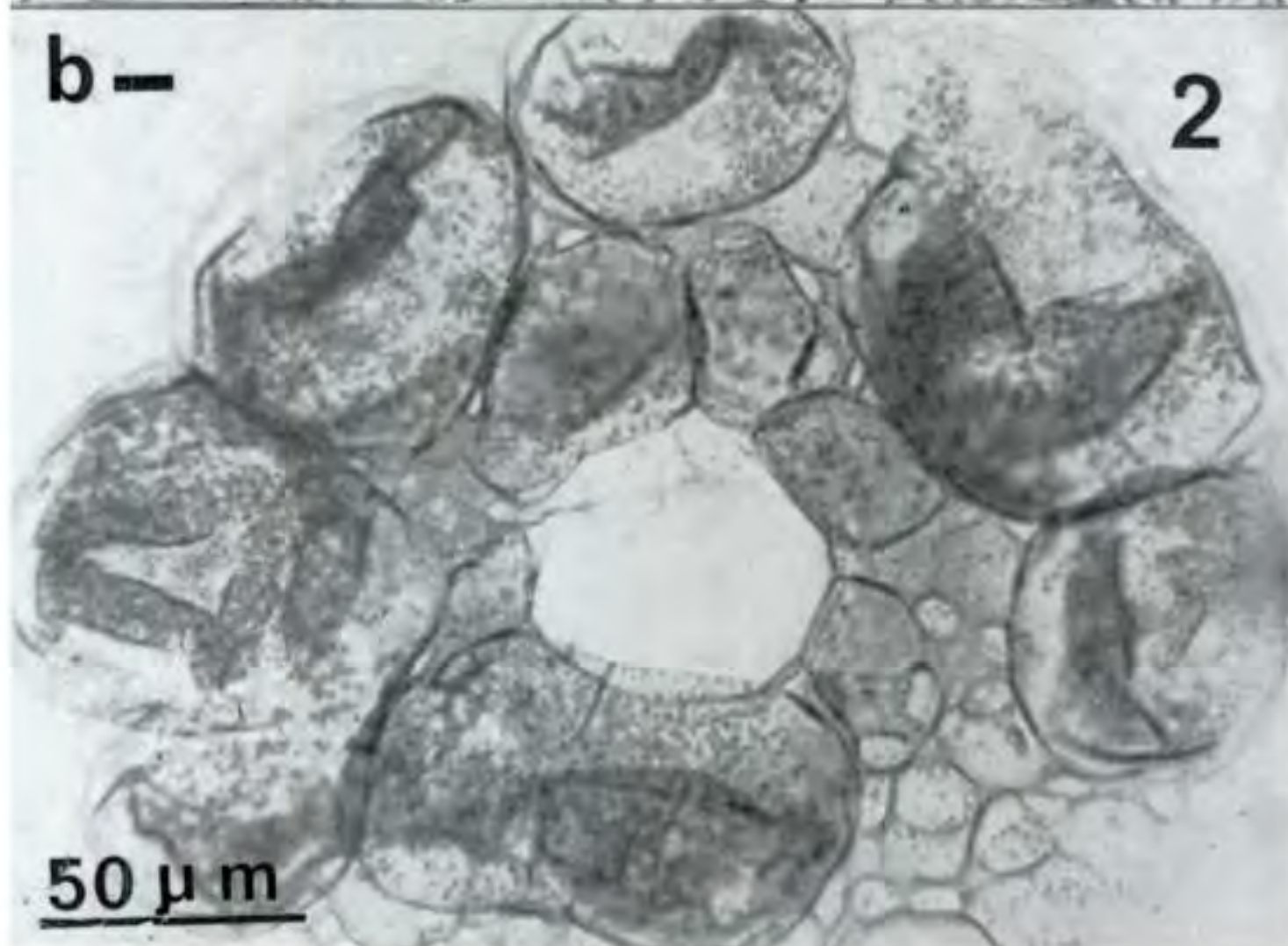
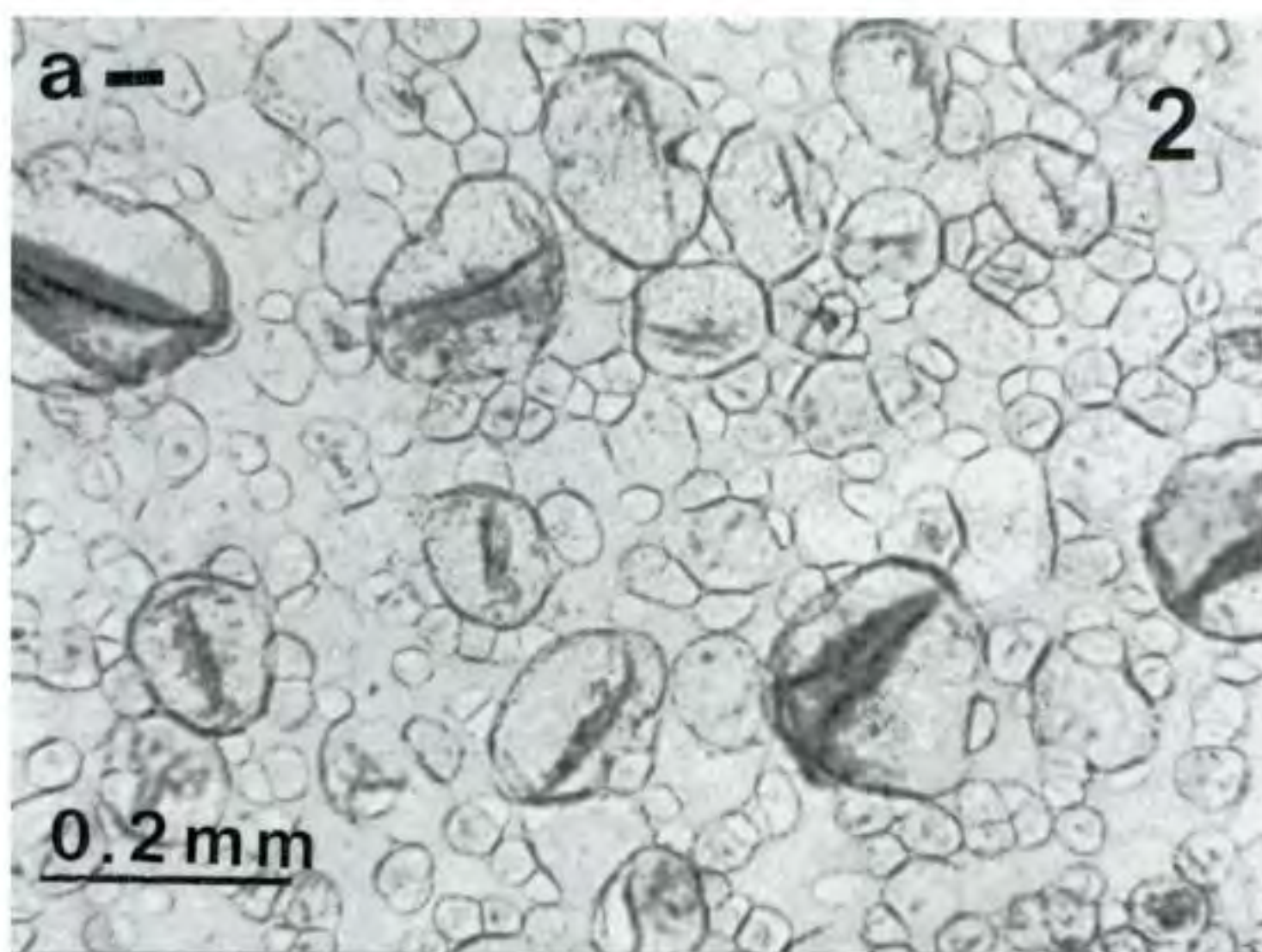


Fig. 33. Cathodic blood. Four samples from the mid-part (2) of the cathodic field. (a+b) Birefringent particles and some "vacuoles". (c+d) Varying size and shape of red blood cells with large often multiple "vacuoles" and birefringent particles. Crenations. Impression of regressive changes.

Fig. 34. Cathodic blood. (a) Samples from mid-part (2) of cathodic field. The blood cells seem to be empty and are of various size. Some are very small, some with a large diameter and a fold-like structure. The large ones are possibly a result of fusion of smaller red blood cells. (b) Conglomeration of "cells" of the large type seen in Fig. 34a form a kind of tissue-like structure around a central hole. Possibly indicating proliferation.



26. Regression and Proliferation in Tissue after Application of Electricity

In Fig. 35a a soft tissue radiograph shows a specimen of human mammary fat in a plastic cylinder between two platinum electrodes provided with irregular surface protrusions to produce edge-enhancements in the applied field. Fig. 35a shows the specimen before application of direct current between the electrodes. Some endogenously developed fibrous structures are present in the fat specimen. After the delivery of 25 C at 10 V during 10 days (1.75 mA).

Fig. 35b shows partial regressions with disappearance of some of the endogenously developed fibrotic tissue **both in the anodic and cathodic part**. At the same time some new coarse cathodic structures have developed to the left and some thin, irregular anodic structures to the right. **Proliferations and regressions are here seen in the anodic as well as in the cathodic parts of the specimen.**

Histological examination of the fat specimen of Fig. 36 reveals that the cathodic coarse fibrous tissue without fibroblasts is collagenous material (Fig. 36a). The anodic material consists of elastic fibrosis with an abundance of fibroblasts (Fig. 36b).

Fig. 37a+b illustrate that development can require both a phase of regression and one of proliferation. Two platinum string electrodes were implanted axially in relation to each other into a piece of human breast fat. 10 V were applied between the electrodes for 17 days resulting in a total of 30 coulombs of current. A histological examination of the specimen is shown in Fig. 37a. In the specimen, fat cells have regressed making a long channel, which on both sides have a dense “fibrous” looking tissue which makes the structure look like a primitive lymph channel. In Fig. 37b an enlarged part of the tissue is presented where the “channel” probably is under development. The “channel” has clearly developed by central regressive changes of fat cells surrounded by atrophic small fat cells. Multiple micronucleoli are also seen in the small fat cells.

It was concluded that the ionic current was tied to both regressive and proliferative changes.

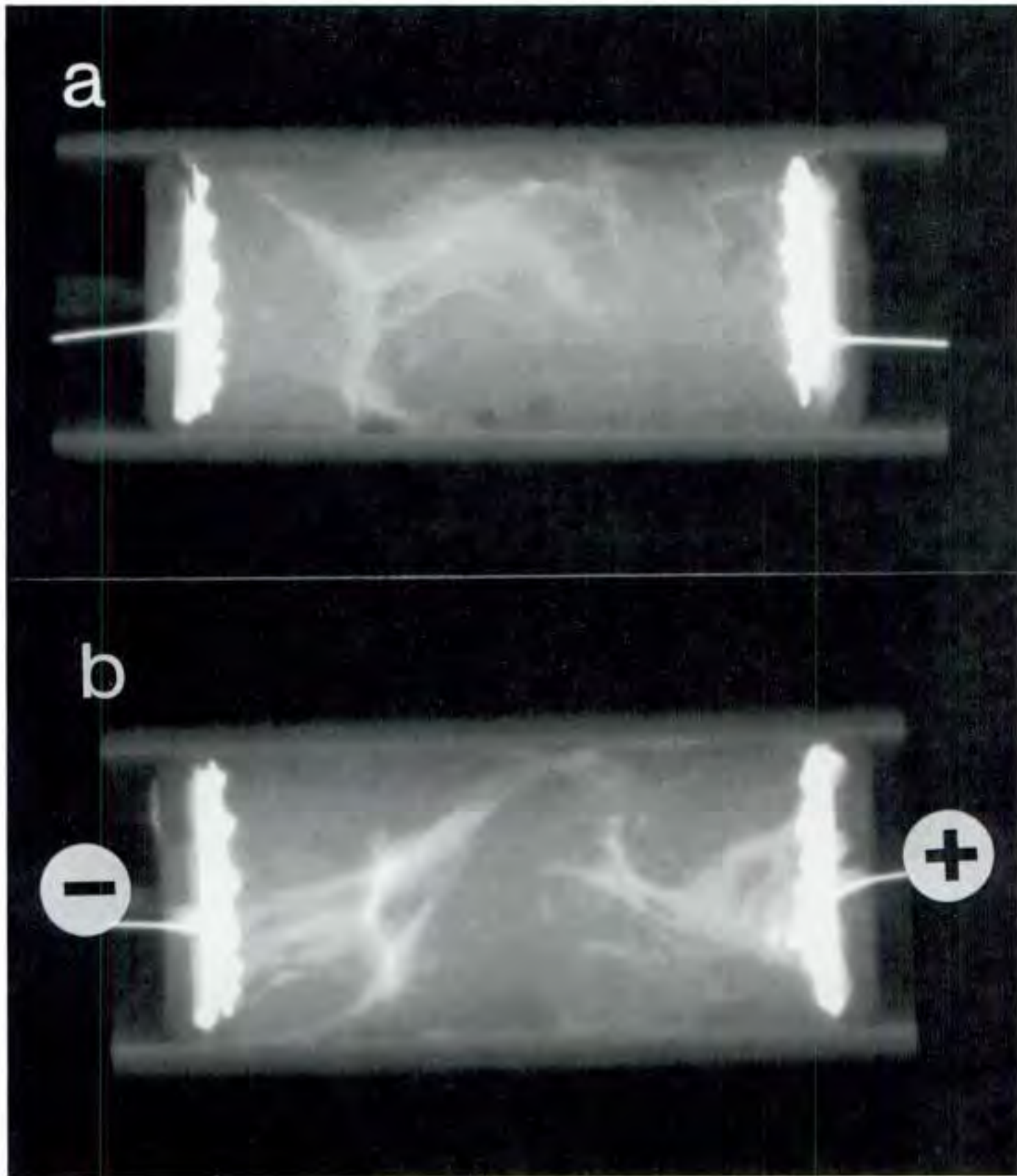


Fig. 35. Mammary fat tissue in a plastic chamber with platinum electrodes at the ends of the chamber. (a) Soft tissue radiograph of the chamber and the fat shows some endogenously developed fibrous structures before application of 10 V, 25 C, 10 days. (b) After this dose some of the **endogenously developed anodic and cathodic fibrosis have disappeared while large amounts of new anodic as well as cathodic fibrous tissue have developed.**

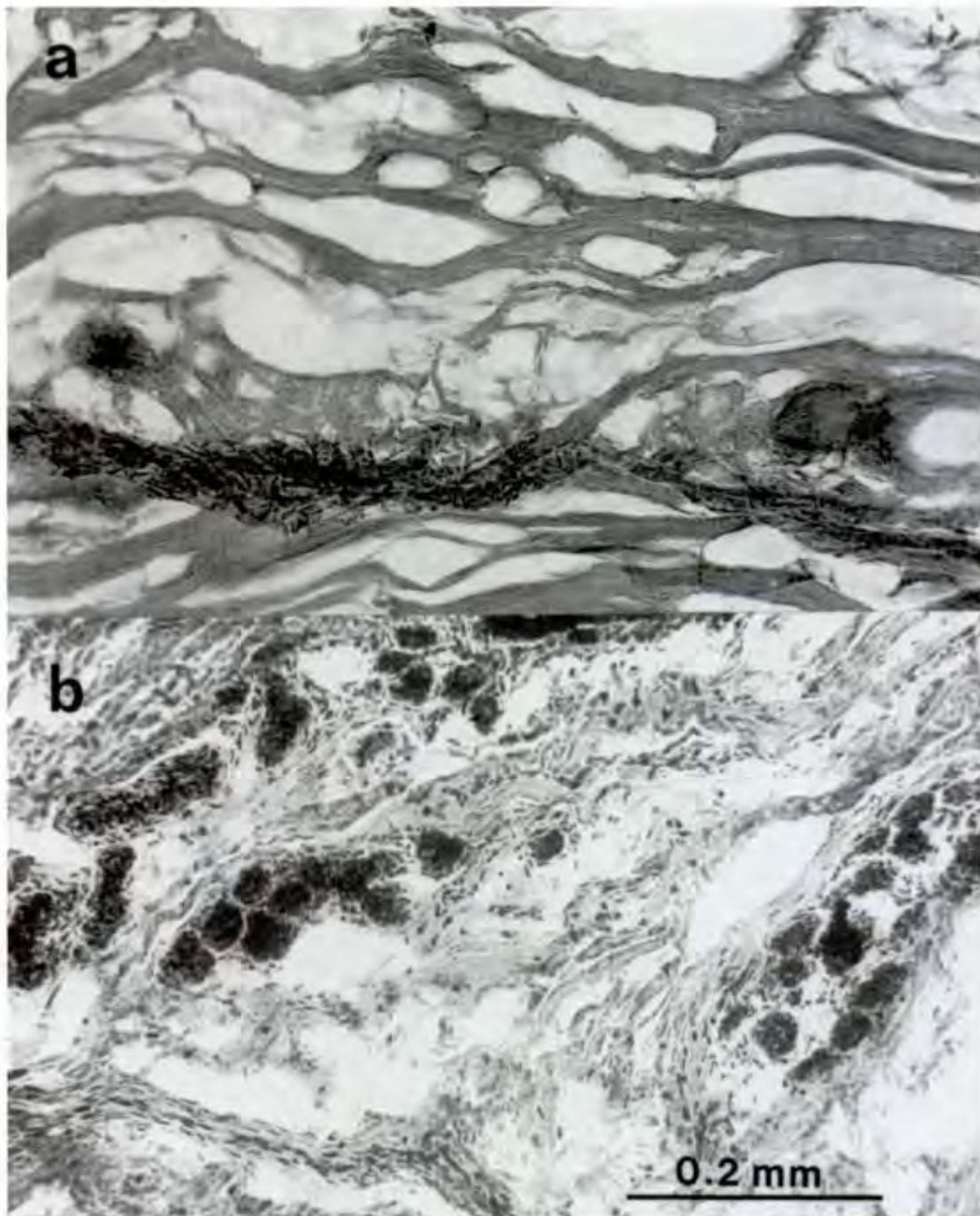


Fig. 36. Histologic specima of (a) collagenous cathodic and (b) anodic elastic fibrous tissue from experiment presented in Fig. 31b. The collagenous tissue contains no fibroblasts but the elastic anodic tissue contains large amounts of fibroblasts.

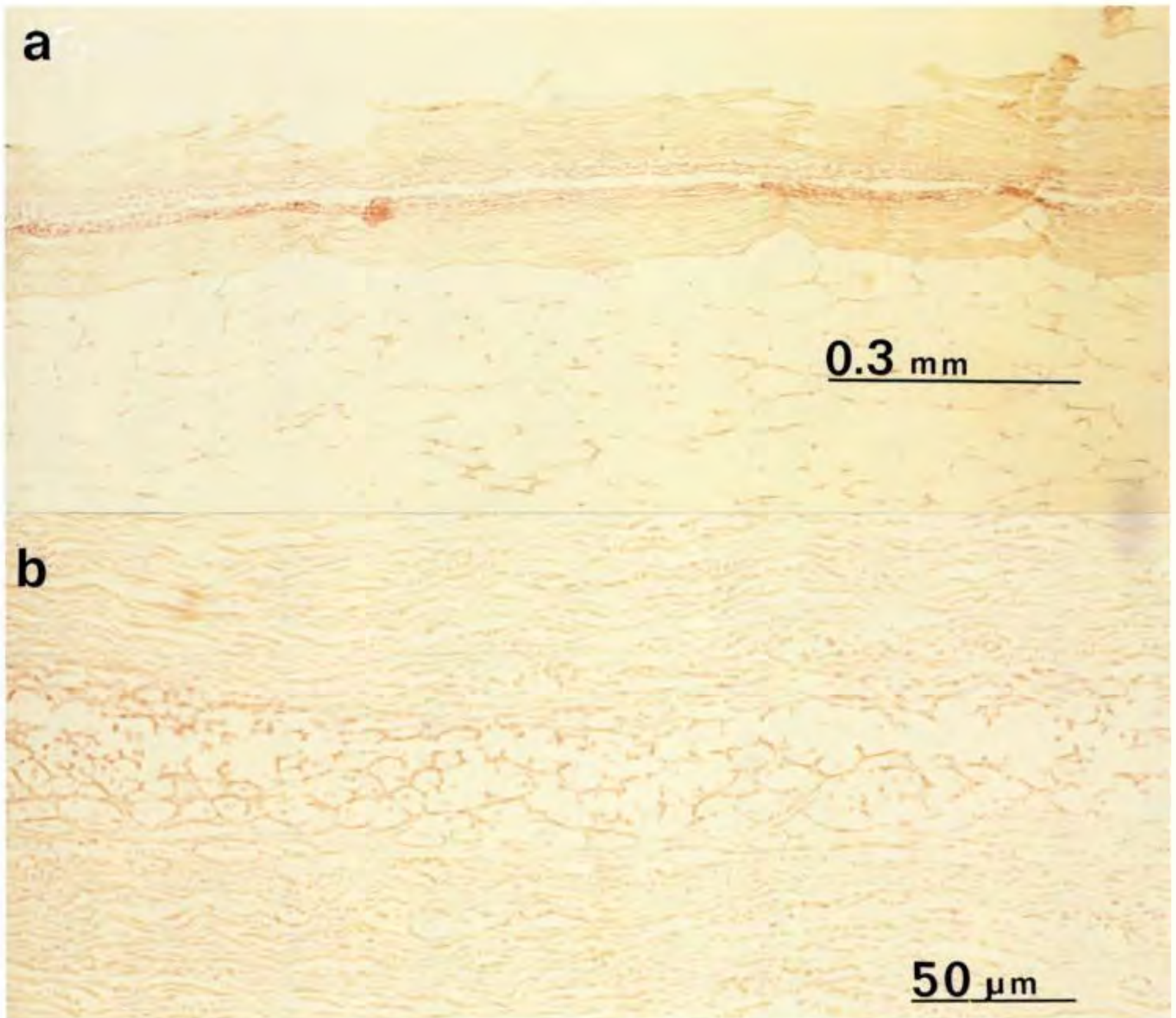


Fig. 37 (a). Human breast fat was exposed to direct current (10 V, 30 C, 17 days) between two 0.2 mm thick platinum string electrodes. The specimen shows a “channel” with condensed small fat cells forming a structure which mimics a lymph channel (*b*). Enlarged view of a section of the “channel” which is only partly open. The fat cells are atrophic and some contain small central nucleoli. The flow of current induces regression and proliferation.

Proliferative regressions are encountered in various connections. E.g. when a road is being constructed through a forest, it is first necessary to remove trees (phase of regression) whereupon a phase of proliferative work can start with what we generally identify as construction of the road.

27. The Evolution of Life

Erasmus Darwin, an English physician, found that the various species undergo changes and assumed that these changes probably depend on some indwelling life-force. His famous grandson Charles Robert Darwin ⁽⁵⁷⁾ wrote “On the origin of species by means of natural selection”. His principle of the importance of “struggle for life” as a mechanism leading to development of adaptation with improved morphology and functions has become a fundamental work among theories of evolution of life. Unfortunately this powerful theory of Charles Darwin does not include any explanation of the driving force which makes species to become gradually more competitive and efficient. Nothing is explained by his theory about the unavoidable degeneration leading to death of the biological species.

Recently Stephen Jay Gould ⁽⁵⁸⁾ has given a modification of the theory of Charles Darwin. In his view life is not necessarily progressive in the Darwinian sense. He has found that the changes of plants and animals are rather a result of series of contingent and fortuitous events. Man, now the leading specie in biology of the earth, may very well rapidly disappear similarly to what once happened to the dinosaurs. Like Darwin, Gould does not take the “normal” unavoidable death of species into account. They further do not include the progressive development of non-biological matter and its final regression (decay) in their theories.

28. Proliferation (progression) and Regression in Biology

From a physical point of view, changes of development (proliferation) and degeneration (regression) must exist in biology as well as is the case with non-biological matter. In principle life and death exist in non-biological as well as biological expressions of circulation of energy. The speed of circulation with energetic interactions is high in biology and varies in individuals and families. Therefore, there are differences in the programming of proliferation (leading to life) and regression (leading to death) as well as other parts of the phases of circulation of energy.

29. Apoptosis

It is understandable that man always has tried to understand why the life-time of biological subjects is limited. What controls the average life-time of man and various animals and plants? In recent years considerable attention has been paid to a concept called Apoptosis which has been connected to an assumed genetic programming of death of cells. Apoptosis will therefore be reviewed briefly.

Normal mammal cells seem to die after a number of divisions, characteristic for various groups of cells. It is thought that cells have obtained a "program" which presents an unbridled growth of any particular type of cells. Also phenomena such as contact inhibition of cells, preventing them from encroaching upon each other, have been considered. Similarly, various other tissue factors supporting growth of nerves, epithelial cells, angiogenetic factors as well as various signalling capabilities between cells have been described. These attempts are all aimed to increase our understanding of the growth and decay of cells and tissue. Apoptosis, a term introduced by Kerr, Wyllie and Currie,⁽⁵⁹⁾ is characterized by the gradual regression of cells towards death. It is thought to occur when various compounds or mechanisms interfere with key functions of the normal machinery of cells. Characteristic apoptotic changes include plasma and membrane blebbing of the nucleus, cellular shrinkage, chromatal condensation and fragmentation, which are described to distinguish apoptosis from cell necrosis⁽⁶⁰⁾. It is thought that apoptosis represents a normal mechanism of cellular turnover, reflecting part of normal development, differentiation, aging and part of the development of disease. Cellular apoptosis can be induced experimentally by various chemical components or mechanisms. An example of spontaneous apoptosis can be observed in the development of the frog. The tadpole has developed a tail for swimming in water. When the animal starts to crawl on land, the tail starts to regress (apoptosis). At the same time legs are being developed.

In the foregoing experiments it was found that regression as well as proliferation may be observed in tissue exposed to direct current. This means that also endogenous flow of current in BCEC-systems as well as artificially applied flow of current can lead to changes, which may contribute to Apoptosis.

Structure and function in Biology are results of interaction of Energy in-

teractions. The energetic phenomena can have the same form, or they can be of different form. Energy interactions lead to new forms of Energy, which involves parts of the Energy circulation process. During each phase of an energetic cycle, existing biological systems undergo an adaptation of structure and function to the “easiest” and most likely form of energetic turnover. If these interactions are unsuitably related to each other, actual structures and functions will deteriorate, i.e. enter into a phase of regression. The new existing energetic prerequisites may be suitable for another direction of structural and functional development which, then, will be favoured. Biology enters a phase of proliferation. The Biological evolution ⁽⁵⁷⁾ is from this view-point not a struggle for life. Biological structuring and function are chosen with respect to the easiest and most likely pathway. Either a phase of proliferation or regression will occur, depending upon the basic physical necessity for the appropriate Circulation of Energy. Similarly Biological Regression of the type we call Aging occurs when the easiest pathway to enter is Regression. Thereby an Eternal Complete Circulation of Energy can take place. Life and Death are necessarily tied to each other in supporting phases of the Energy Cycle.

The apoptosis of the tail of the tadpole (phase of regression) is tied to a phase of proliferation at the development of the hind legs of the frog. But a more evident example of the necessity of phases of regression and proliferation tied to various parts of the circulation of energy will be given.

30. Circulating Light – Temperature Energy, Interacting with Biological Energy of Trees, Leading to Phase of Regression (Apoptosis in Restrictive Sense) and Phase of Proliferation (Regrowth and Survival)

Annual light-temperature variations have significant influence on plants and trees. A tree saves its life during a cold winter by sacrificing its leaves in the fall. Reduced light and lowering of external temperature interact with the metabolism of the leaves of a tree. Continuation of metabolic processes in the tree stem leads to inflow of water, electrolytes and nutrients and also chlorophyll and other compounds from the leaves. They then turn yellow or red by carotenoids and become later on brown and dry (Fig. 38a). The dead leaves fall off. The holes where the stalks had grown are sealed by a cork-like fluid material. The remaining electrolytes, chlorophyll, water etc in the leaf continue to interact in some restricted type of metabolism which results in a corona outside the “dead” leaf which here is visualized in a Kirlian photography (Fig. 38b). The regressive apoptotic events are subsequently tied to proliferative events. In spring-time, similar more favorable external light temperature conditions will interact with the preserved energy of the tree, partly saved from last year, and the same kind of leaves that were present the previous year will start to grow under guided interaction by the circulating energy.

The concept of apoptosis partly covers regression and proliferation to various specified life events or partial tissue modifications in biology. As long as apoptosis does not cover more than parts of life-spans in biology it is useful with the terms proliferation and regression. This concept can also be used for non-biological matter and the complete cycle of circulation of energy.

In apoptosis it is emphasized that the cells of the body have various genetic “programs of death”. It is also true that various parts of a man’s body dies at different time. A person who is diagnosed dead because heart, lungs and brain have ceased to function still possesses cells which continue to proliferate for some time. Thus nails, hair, beard continue to grow several days after a clinical death of heart and brain. A similar “differential life-

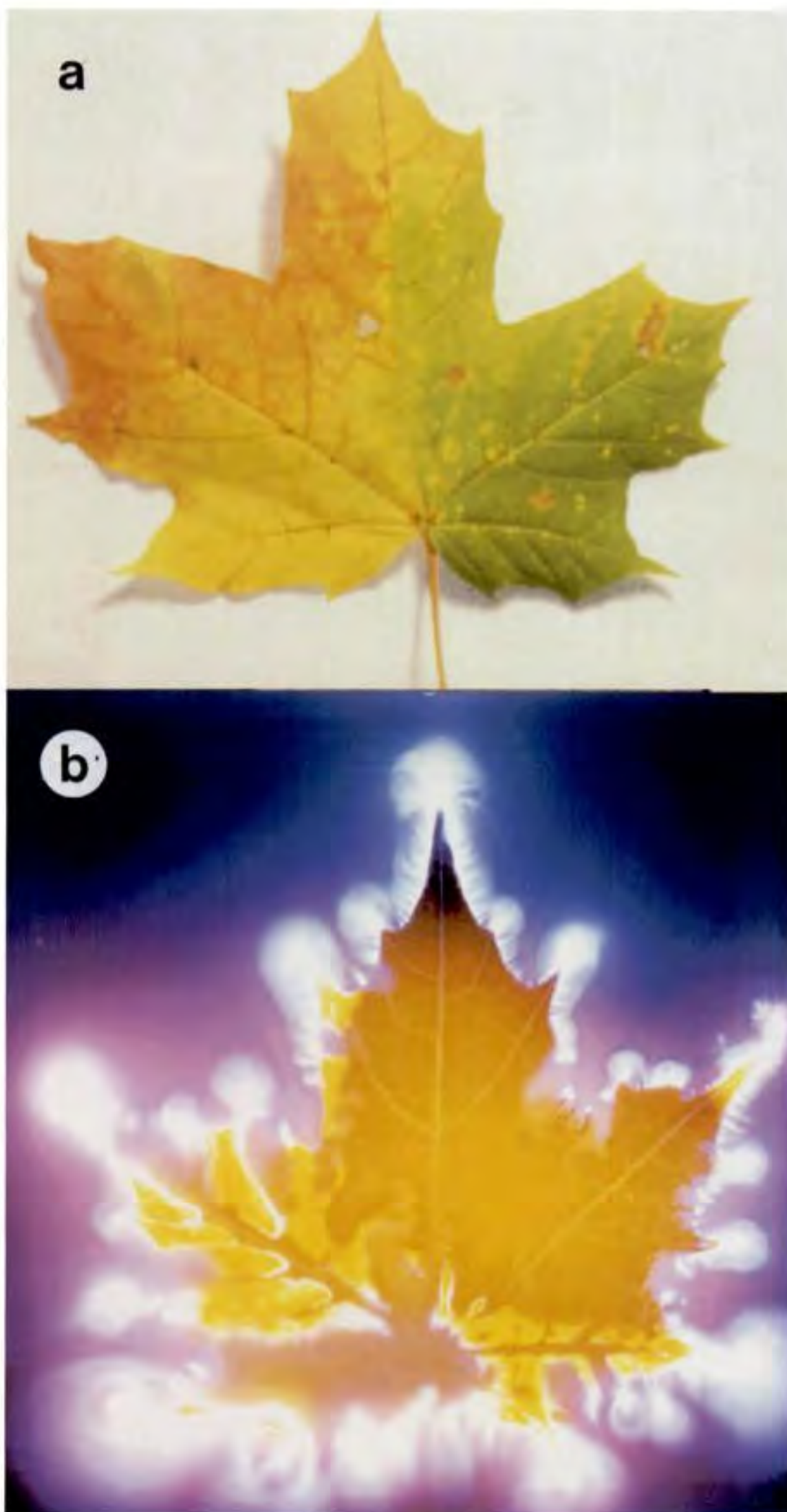


Fig. 38. (a) Maple leaf. In the fall, they turn yellow, red and brown before they fall to the ground. Some water, electrolytes, nutrients, chlorophyll remain in the “dead” leaves where they still present some false “metabolic” reactions from chemical gradients that can produce a flow of ions. (b) An expression of the EMF is seen in the Kirlian photography of a “dead” maple leaf. It shows the corona around the leaf produced by the remaining electrochemical reactions with ionic flow inside the leaf (Kirlian photography, courtesy of C Lindmark).

time” is also encountered in man-made tools and machines. An automobile, which is generally expected to function 15 years, must have its worn out parts replaced during its “life-time”. Similar failures of organs and cells in man may not necessarily depend upon genetic factors.

The proliferation and subsequent regression of EMF derived non-biological matter does not seem to have any connection to genetic factors. Non-biological and biological matter have developed at condensation of EMF-energy which have led to identically equal building blocks – The Atoms. These atoms, therefore, form a common basis for the development of **non-biological and biological material and systems**.

31. Origin of Biomolecules

Only relatively small amounts of organic compounds exist on the surface layers of the earth. The proliferation of these organic compounds into biological structures first led to the opinion that biomolecules probably have developed in ocean water. Oparin and Orgel ^(14, 15) suggested in the early 1920s that the early atmosphere contained methane, ammonia, H₂ and water vapor. These gaseous compounds exposed to radiant energy should lead to formation of amino acids which could precipitate into the ocean where they may have proliferated into larger biomolecules and cells. These theories remained dormant for about 20 years when Stanley Miller ⁽¹⁶⁾ started experiments to test Oparin’s and Orgel’s theories. The experiments can be described roughly as follows: Stanley Miller, then working in Harold Urey’s laboratory, accepted his proposal to perform experiments, during a limited time, to investigate the idea of Oparin and Orgel. Oparin had proposed that a “reducing atmosphere” at the presence of methane, ammonia, hydrogen and water was necessary for the development of biological molecules. Harold Urey was unaware of Oparin’s work, and he had the same idea about the importance of a “reducing atmosphere”. Miller made the experiments in Urey’s laboratory. In 1950 the four compounds were placed in a flask which he heated to 80°C, forcing water vapor to circulate through a compartment with ammonia, methane and hydrogen. This compartment also had electrodes between which electrical sparks could be

produced. After about two weeks, the content was examined. From the non-organic compounds CH_4 (methane), NH_3 (ammonia), hydrogen gas (H_2) and water had various organic compounds such as α -amino acids, e.g. glycine, alanine, aspartic acid, etc developed. Several other organic compounds such as formic, acetic, propionic and lactic acids were also found.

These important discoveries were published in 1953 but were met with criticism of various hypothetical factors such as heating of the “soup” of components and how the right sequences of proliferation could have occurred in the sea as well as how the radiant energy was added to activate the processes for each of the reactions. It has also been thought that the concentration of various components, such as ammonia, must have been very small in the sea. An important prerequisite for Miller seems to have been the presence of methane, ammonia and hydrogen gas in water vapor which formed the “reducing atmosphere”. In this atmosphere, electric sparks were produced between electrodes. Nobody questioned the chemistry of the experiments. According to Miller: “when you see the organic compounds dripping off the electrodes, there is little room for doubt.”

Some comments will here be presented concerning the experimental electric sparks in the “reducing atmosphere” of Orgel, Oparin and Miller.

It is important to understand how a lightening in the atmosphere of the earth works. We do not know exactly this but certain series of events are known. A description has been presented by Feynman ⁽⁸⁾ and will be partly described as follows:

Usually a large cloud with electronegative bottom and electropositive upper part is positioned over the earth. The earth is electronegative in relation to the electronegative bottom of the cloud. The electric events start with formation of a **step leader**. A small bright spot starts from the cloud and moves down about 50 m at one sixth of the speed of the light. The spot stops 50 microseconds and starts again to move down 50 m, whereupon it stops and so on until ground is reached. In the step leader negative charges are moving from the cloud. The moving electricity in the leader is thought to ionize the air around the leader which is surrounded by a conducting layer. When the leader reaches ground the conducting layer around the leader will act as a “wire” for a “return flow” of charges from the ground to the strongly electronegative cloud (a closed circuit is formed). The return flow can be observed as the bright flash of the lightening. The flowing

charges upward heat and expand the air which causes the thunder. The flow in the circuit is maintained by the down flow of electrons in the step leader. This represents a forceful **oxidizing current** which reaches ground. Collections of electron accepting molecules such as methane, ammonia, H_2 gas will thereby be “reducing” the electrons of the step leader, which then leads to the observed transition of the compounds into amino-acids etc. So far, the mechanism of lightening seems to support Miller’s experiments.

The difficulties in understanding how various basic products, such as amino acids, etc, can proliferate into a system of “biological life” have forced many scientists, including Miller, to turn to “Exobiology”, a term coined by Joshua Lederberg. The term means the study of life beyond the Earth. But no life is known on other planets so far. Still, the most favorable conditions for life exist on earth. This should make “Endobiology” the most fruitful field of research for the understanding of development of biological life. It seems reasonable to accept the criticism which assumes that the precipitation of amino acids etc from the atmosphere to the sea might have occurred in very small concentrations. The proliferation of these into larger molecules etc may therefore need a complementary theory. Such a theory will be proposed, based on the principle of closed circuit interactions of simple non-organic compounds and their proliferation into biomolecules.

32. Increase of Coincidental Contacts among Particles in Closed Circuit Electrical Channels in Sea-water Represents a Precursor Mechanism of “Self-proliferation” of the BCEC-systems Organizing Biological Structuring and Function

After eruption of submarine volcanoes into the oceans, hot lava will gradually cool under formation of pumic stone. The lava contains collections of gas products, which form cavities and stretch the hot lava which shows tubular channels. Such channels will present open ends at crackings of the pumic stone material and will fill with salt-water. Conductive ionic loops

form because the tubular ends are short-circuited by the surrounding salt-water. External moving electromagnetic fields in the atmosphere or the motion of salt water, producing electromagnetic fields, will induce ionic currents in the salt-water of the tubular conductive loops. The possibilities of “external” EMF flow may be a realistic assumption because electrical atmospheric discharges are not uncommon. Each day, about 40,000 thunderstorms occur on earth producing more lightening ⁽⁸⁾. It is estimated that there are about 100 lightening flashes per second world-wide with a peak in the activity at 7:00 pm Greenwich mean time. The salt-water is constantly moving, which induces streaming potentials capable of inducing currents. Ionic “impurities” of the salt-water will then present coincidental contacts by their differential mobility induced by the moving EMFs. Evidently many other factors such as gravitation, molecular forces, pressure and temperature must be contributing. It therefore seems possible that the results of Miller’s in vitro experiments are followed by the necessary proliferations and structurings of the compounds by electrophoresis, serving as a precursor mechanism for development of BCEC-systems. The latter are numerous in Biology also leading to both structurings and functions. Other contributing mechanisms certainly also exist in “Endobiologic” proliferations. Recently it has been shown by Rebek Jr ⁽⁶¹⁾ that molecules crafted in the laboratory can also make replicas of themselves. This capability is important for the development of life.

In fully developed BCEC-circuits, avalanches of electrochemical reactions might have ensued with rapid creation of continuously more complex and efficient BCEC-systems. This would help to explain the rapid development and function of biological matter.

33. A Diagram of Eternal Circulation of Condensed EMF-energy-matter, its Progression and Regression, with Transfer into Biological Matter and Functions via BCEC-systems

(Fig. 39)

An extension is made of the diagram in Fig. 4, which has told us that the EMF, by condensation, forms matter. This matter proliferates and decays for recirculation to its origin – the EMF.

The new element in the diagram (Fig. 39) is the indication that a transition of non-biological matter also proceeds into biological matter which is ascribed the mechanism of BCEC. Proliferation leading to “life” and regression to “death” are thought to be balancing parts of the eternal circulation of the EMF of the universe. Death and Life in the meaning of leading to proliferation and regression can accordingly be ascribed non-biological matter as well as biological matter. Life and Death are always following each other in the Endless Circulation inherited in the EMF of the universe, following an overall Guiding Principle ^(13, 17).

Fig. 39 indicates that the EMF of the universe first condenses forming particles, i.e. matter. Particles then proliferate forming atoms, which form molecules etc. In the beginning, the EMF seems to inherit a vector of expansion associated with proliferation of matter. The initial dominance of this vector is then gradually taken over by a field-vector of condensation and regression forcing all matter to rejoin the EMF with the universe.

A theory is presented that part of non-biological matter proliferates into biological matter by the influence of the mechanism of BCEC. This process may have started as simple electrophoresis already in the premordial sea. This theory is a supporting continuation of the theory of Orgel, Oparin and Miller.

The EMF of the universe has been described as the energetic base for the development of our physical world. In the Orient it is assumed that there exists a “Life force” called Chi, which also circulates. Chi (or Qi) is said to circulate in the meridians (channels or jing-luo). Each of the twelve primary channels have surface trajectories with specific locations for stimulation (acupoints or jing-xue). Chi is involved with two factors (often

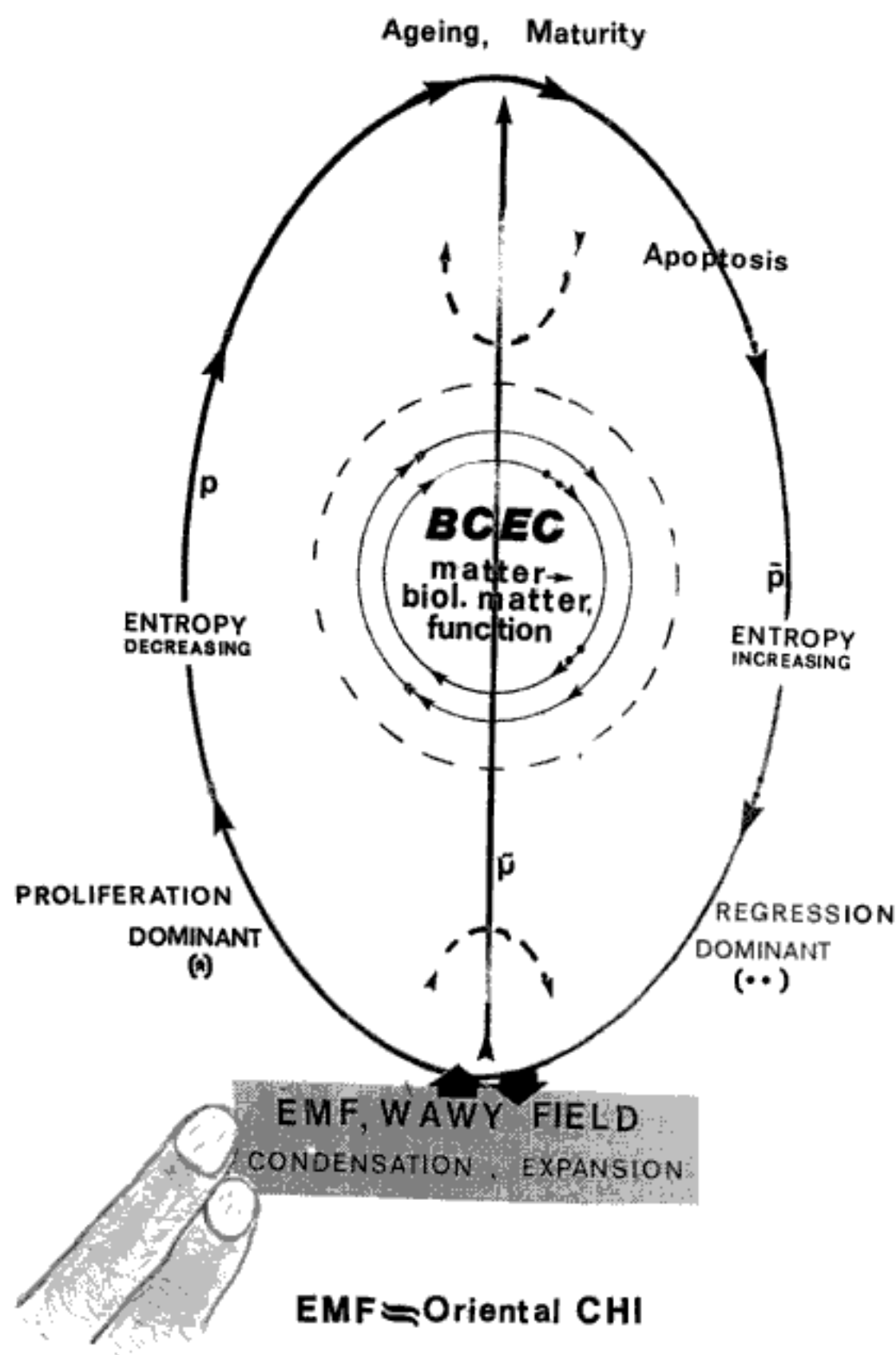


Fig. 39. An Extended Vacuum Diagram (compare Fig. 4) illustrates **Non-Biological and Biological Matter** in circulation. Our physical world and its functions are dominated by the changing characteristics of the electromagnetic field energy and its co-transported particles at condensation and expansion. Condensed EMF energy is matter which expands under proliferations and regressions, following sequences of various expressions of energy in an eternal zero circulation. There are no principle differences of proliferation and regression of non-biological matter as compared with biological matter. Structural and functional transitions of matter into biological matter are dominantly tied to the mechanism of electromagnetic circulation of energy expressed by Biologically Closed Electric Circuits (BCEC). The energy required is here ascribed the Unified EMF of the Universe, which to the author is equivalent to the Chi (Ci) energy of the Orient. No one knows where these energies come from or how they obtained their properties. To indicate this, two fingers are shown with their tips resting onto the EMF of the Universe (or Chi energy if this term is preferred).

considered as opposing) called Yin (associated with matter) and Yang (associated with energy). Energy moves from Yin to Yang, and good health involves the proper movement of this energy through the meridians. To the author, the EMF of the universe is the source of the Chi life force. Yin and Yang are related to the opposing charges, indicating V-fields and forces which promote co-transport with the flowing EMF. The meridians are pathways for the flow from Yin to Yang. In Biology, the Chi circulation and Yin to Yang flow have similarities to the induced fields, associated forces and flow of positive and negative particles in electrolytes, blood and lymph vessels, etc. The flow of “ionic electricity” in biology requires closed circuits. The “return flow” in bioelectricity is often poorly described. The same seems to be the case for closed circuit flow of Chi. The superficial meridians described are not followed-up with description of meridians carrying “return flow”. In attempts to define the return pathways for flow of ions in bioelectricity, the circulation of Chi and the transition from Yin to and Yang in meridians, further steps can be taken to a mutual understanding between Western bioelectricity and Eastern concepts of circulation of Chi.

One thing is evidently common for EMF and Chi energy. We have no idea of where these energies come from and how the energetic characteristics have developed. To indicate this in Fig. 39, two fingers are depicted leaning with their tips onto the EMF (or the Chi of the universe if this term is preferred).

34. Summary

This book represents a continuation of the earlier published Biologically Closed Electric Circuits (BCEC), which described a previously unrecognized **Circulatory System** in Biology. This system is coupled to the electrically conducting media. A distinction is here made between electricity flowing in metallic cables (**Electronic Electricity**) and electricity flowing in electrolytes (**Ionic Electricity**). In both instances an electromagnetic field makes co-transport with charged particles. In metallic cables electrons make the co-transport. In the BCEC-systems, the EMF dominantly makes co-transport with ions. But the BCECs also contain short steps of electron transfer via redox proteins. The BCECs are therefore said to be powered by **Bioelectricity** (i.e. dominantly ionic but also with electronic electricity).

The most dominant part of bioelectricity powering the BCEC-systems is its EMF component. Unfortunately, our knowledge of EMF characteristics is incomplete. Therefore the present study of the important mechanism of BCEC is limited to some aspects of EMF-interactions such as activation and guidance of BCEC.

Some fundamental characteristics of the EMF are recognized such as its presence everywhere in the Universe, and its tendency to flow in closed circuits. The flow of EMF in electrolytes takes place in spirals (vorteces). The chirality of anodic and cathodic vorteces is demonstrated experimentally as well as the behaviour of co-transported particles by the EMF. When in an electrolyte, the anodic and cathodic fields approach each other a **Field Quenching** will take place resulting in liberation of co-transported anodic and cathodic particles. Proliferation of these takes place by gravitation and molecular concentration forces. A particular detail of the field effects is found and described as a central “core” inside the vortex formations. The spiral fields making co-transport of particles of positive and negative charge will, when the approaching EMFs interact with each other, lead to partial strengthening or counteraction and even quenching of the fields. The interactions of an anodic and cathodic field have also been utilized to obtain artificial structuring in vitro of dielectric material and to produce **chaos** of structures. In vivo is this partly a way to create sponginess of incurable cancers using quasielectrostatic fields. Created spongi-

ness makes it possible for chemotherapeutic agents to enter the deep parts of a previously dense malignant tumor, which thereby can regress completely. An example of rapid disappearance of a large cancer in this way has been described.

A summary of the basis of BCEC is presented as well as certain characteristics of the BCEC-systems. It is further emphasized that certain BCECs are activated by distant EMF-signals e.g. in the activation of the poorly conductive axons of circuits such as the Vascular-Interstitial Neuro-Muscular Circuit (VINMC).

The principle of spontaneous polarization of a cancer (by its internal necrosis) in relation to surrounding tissue is emphasized. The potential difference will lead to activation of BCECs, which leads to ion transports giving rise to **corona structures** around the cancer. These tend to separate the cancer from surrounding normal tissue. In this case, the tumour-corona is an expression of the tendency of spontaneous healing of a cancer.

The internal flow of ions in animals or man produce an external EMF-corona, which can activate conductive BCECs in other living systems. This is shown experimentally by moving a hand across the tail of EMF-shielded mice. The EMF-interactions are used by animals for capturing of food in (e.g. certain fishes) and for warning. A cat taking a walk puts the tail vertical in "antenna position" because an approaching enemy will, with its EMF, interfere with the corona of the tail of the cat.

Applied EMF on blood is studied in in vitro. These studies indicate that field-induced proliferations and regressions take place **both in the anodic and cathodic fields** with the application of DC electricity. This is also shown to be the case in studies of tissue specima. The circulation of the EMF of the universe is tied to progression and regression of matter (also of Biological matter). The evolution of life and necessity of regression (decay) are consequences of the eternal circulation of the EMF.

Apoptosis ("programmed cell death") is discussed in terms of proliferation and regression which partly takes place by the mechanism of BCEC-systems.

It is well known that ions migrate with various speed in an electrophoretic circuit. Thereby the migrating ions will get an increased tendency of contact after a sufficient length of time. Consequently coincidental contact-reactions will increase, leading to an augmentation of the tendency of proliferation of molecules. At the induction of gradual proliferation of the

BCEC-systems these are likely to have participated in the development of biological matter. It is proposed that the developed BCEC-systems forming vascular, lymphatic, interstitial, etc, closed circuit channels in animals, and corresponding systems in plants, may have their origin in simple electrophoretic circuits which may have started in the oceans.

This idea connects to the theory of Oparin ⁽¹⁴⁾ and Orgel ⁽¹⁵⁾ which was experimentally tested by Miller ⁽¹⁶⁾ who found that various non-organic compounds in water, exposed to electrical sparks, led to development of many essential amino acids.

It is stressed that our physical world of morphology and functions is based on the inherited tendency of the EMF condensation and expansion. This leads to Proliferation and Regression of all matter in an eternal circulation of energy of the EMF of the universe. A basic important mechanism for transfer of non-biological matter into biological matter is attributed to the BCEC-systems.

Fundamentals of BCEC

- Development and Regression of matter depends on the capability of Energy to change its form and behaviour. Sequences of varying expressions of energy proceed as an Eternal zero circulation.
- There are no principle differences of proliferation and regression of non-biological matter such as a stone as compared with biological matter of plants and animals.
- The structural and functional transitions of matter into biological matter is dominantly tied to the mechanism of electromagnetic circulation of energy expressed by Biologically Closed Electric Circuits (BCEC).
- Man is born, grows up, ages dies and decays presenting various phases of the circulating electromagnetic Field, revealing our origin and destiny.
- In man and animals, the BCECs have their most efficient mechanical support in the Circulatory systems of blood and lymph fluids. The final energy transfer in Biology is electrochemical. The ultimate carrier function of these processes is provided by the BCEC systems.
- The Mechanical Circulation of blood and lymph are coupled to the final Circulatory System of BCEC at electron transfer of redox reactions.

35. Addendum (Link to Exobiology)

Theory of development of spiralling nebulae, proliferation and deposition of planetary matter including water and clouds of antimatter (positrons) and matter (electrons) in our galaxy

The mechanism of vortex formation in Biology is often disclosed by biological structuring and functions.

Thus, the heart muscle presents **Vortex Cordis** with spiralling fibers at the apex which continue in Outer oblique and Inner craniocaudal fibers. Inbetween these layers strong circular muscle fibers produce at contraction the emptying systolic function. Contraction of the Vortex Fibers and their continuation in the Outer and Inner layers tend to relax the heart in diastole by making the cavities spherical.

In his studies of interaction between electromagnetic field and biological matter Swen Alfars ⁽⁶²⁾ has presented an appealing theory of the origin of the DNA-Double Helix ⁽⁶³⁾.

It has been said that biological interactions on the earth, occurring on a small scale, do have their **Physical Correspondence** on the celestial scale.

Extrapolations of experimental results described of in vitro electrophoresis were made to present this **Principle Theory**.

The formation of our physical world is based on theoretical considerations. The prevailing concept is usually tied to the assumption that all matter of the universe has, by gradual condensation, formed a ball of internal high pressure and temperature. Four to six millions of years ago the ball of matter exploded. The giant explosion is called the "Big Bang". During the first hour all nuclear reactions took place which led to the development of all elements. The temperature then lowered but the cosmic matter including gases continued to expand with increasing speed towards the periphery of the universe. At the same time cosmic matter is thought to have "organized" under the influence of gravitation with the formation of billions of nebulae such as "our own" Milky Way. With the Milky Way, 30,000 light years from its center, a "small spot" is located, which represents our planet, Tellus.

In the search for antimatter in the Milky Way it was recently found by a team conducted by the astronomers Dr. William R. Purcell at the Northwestern University, USA and Dr. James D. Kurfess at the Naval Research

Laboratory, USA, large clouds of antimatter (positrons) close to the center of our galaxy. One large cloud of positrons was also found 3,000 light years above the central parts of the Milky Way. This cloud of positrons was only positioned on the “north side” of the galaxy and not on the “south side”. The origin of these new and “unexpected” sources of antimatter in the Milky Way is a mystery according to William R. Purcell. Reports on these findings have been made by Schewe, Philip F. and Ben Stein: A New Celestial Source of Positrons. The Am. Inst of Physics News, No 319, April 29, 1957 and by Sahli, Jim, Goddard Space Flight Center, Greenbelt, M.D., Savage, Don, Headquarters, Wash. DC. Schultz, Janice, Naval Res Lab Washington, DC: Antimatter clouds and Fountain, Discovered in the Milky Way Release of Nasa News, No 83, April 28, 1997.

The existence of clouds of antimatter (positrons) and matter (electrons) in the universe indicate the existence of, in relation to each other, electrically polarizing regions.

There are only two known forces which can influence on mass transport of matter over large distances in the universe; gravitation and the electrical forces. Gravitation influencing upon matter is a primary factor in creation of high internal pressure and temperature of matter preceeding the “Big Bang”. The further development of matter still needs to be explained. There, the electrical forces may be considered. In essence there is only one kind of force in our physical world and that is the electrical force (compare Yin Rui: Rotating Lorentz Transformation and Unification of Forces. BUAA Press, ISBN7-81012-738-1, Beijing, 1997).

Of the electrical force the EMF is the fundamental base. It exists everywhere in the universe. It is thought that a theoretical estimation might be of interest of the in vitro model-studies described of the mechanism of electrophoretic transports in attempts to explain the formation of some of the observable structured elements in the universe. This should also require the identification of a mechanism of closed circuit electrophoretic transports.

The first structural objects to be considered are the nebulae.

An example of such a giant spiral structure is shown in Fig. 40, representing the galaxy M 81, according to John Herschel (General Catalogue of Nebulae, Philosophical Transactions of the Royal Society of London, vol. 154, 1868).

The model mechanism to start with is represented by the in vitro dem-



Fig. 40. The galaxy M 81 (within the Big Bear) shows a central dense part surrounded by "arms" of spiralling matter.

onstration of anodic and catodic, each other approaching vortex spirals (Fig. 16a–d and Fig. 17a–b). The existence of EMF-spirals between matter and antimatter in the universe is a possibility which may not be overlooked. Matter (electrons) and antimatter (positrons) polarizing in relation to each other can be anticipated to lead to towards each other flowing vortices of expanding anodic and cathodic EMFs, flowing through everything including vacuum. Charged and dielectric particles will be caught and carried by the EMF until a field quenching will liberate positive, negative and dielectric particles reacting with each other forming planetary matter.

In Fig. 41 moving electropositive and electronegative vortices are moving towards each other, as indicated graphically. To facilitate the identification of the individual spiralling “field lines” the anodic vortex “lines” have been provided with black dots. It is thereby possible to recognize the varying inclinations of corresponding positive and negative “vortex lines”. It can be seen that the positive and negative flow should partly enhance and partly counteract each other. In some instances, aligned anodic and ca-

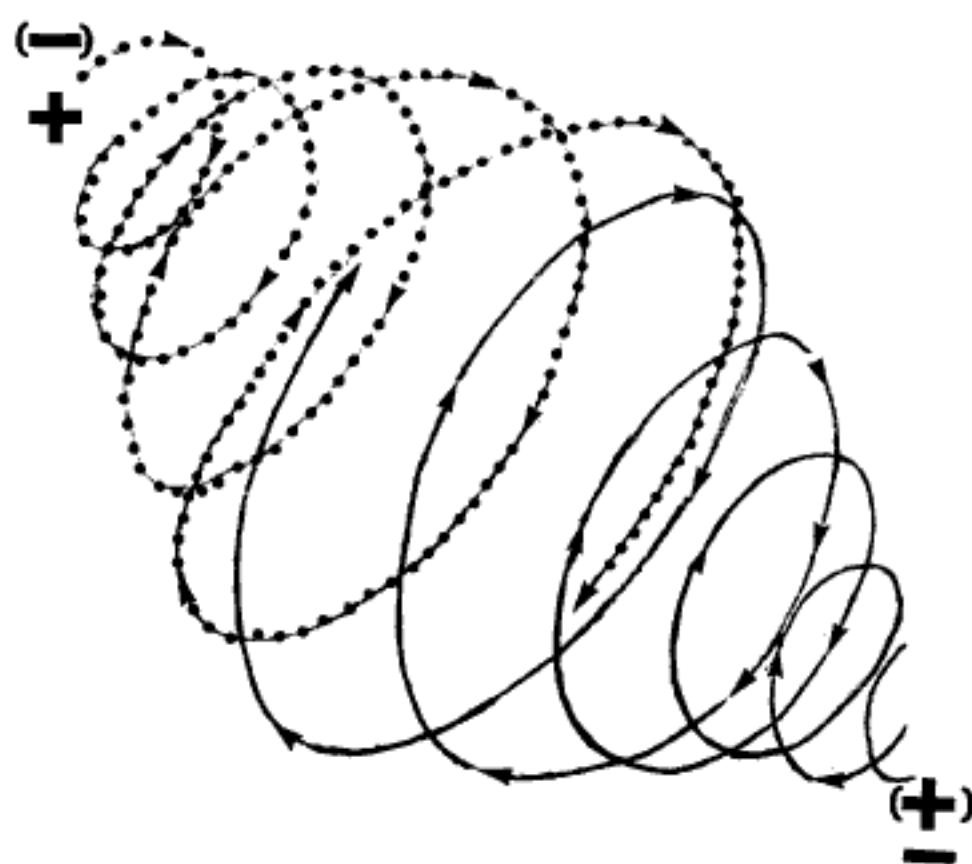


Fig. 41. It is suggested that galaxies are structured by electropositive and electronegative EMF-vortices (See Fig. 16, 17) between polarizing matter and antimatter. The EMFs make co-transport of charged particles. When the fields meet they interact. To make identification of “field lines” easy, the anodic field is provided with black dots. Where the fields counteract (quench) each other the co-transported particles are released from the transport function of the EMF why they start to interact **forming new matter** (See also Fig. 14, 15) **including water** at $H^+ OH^-$ interaction.

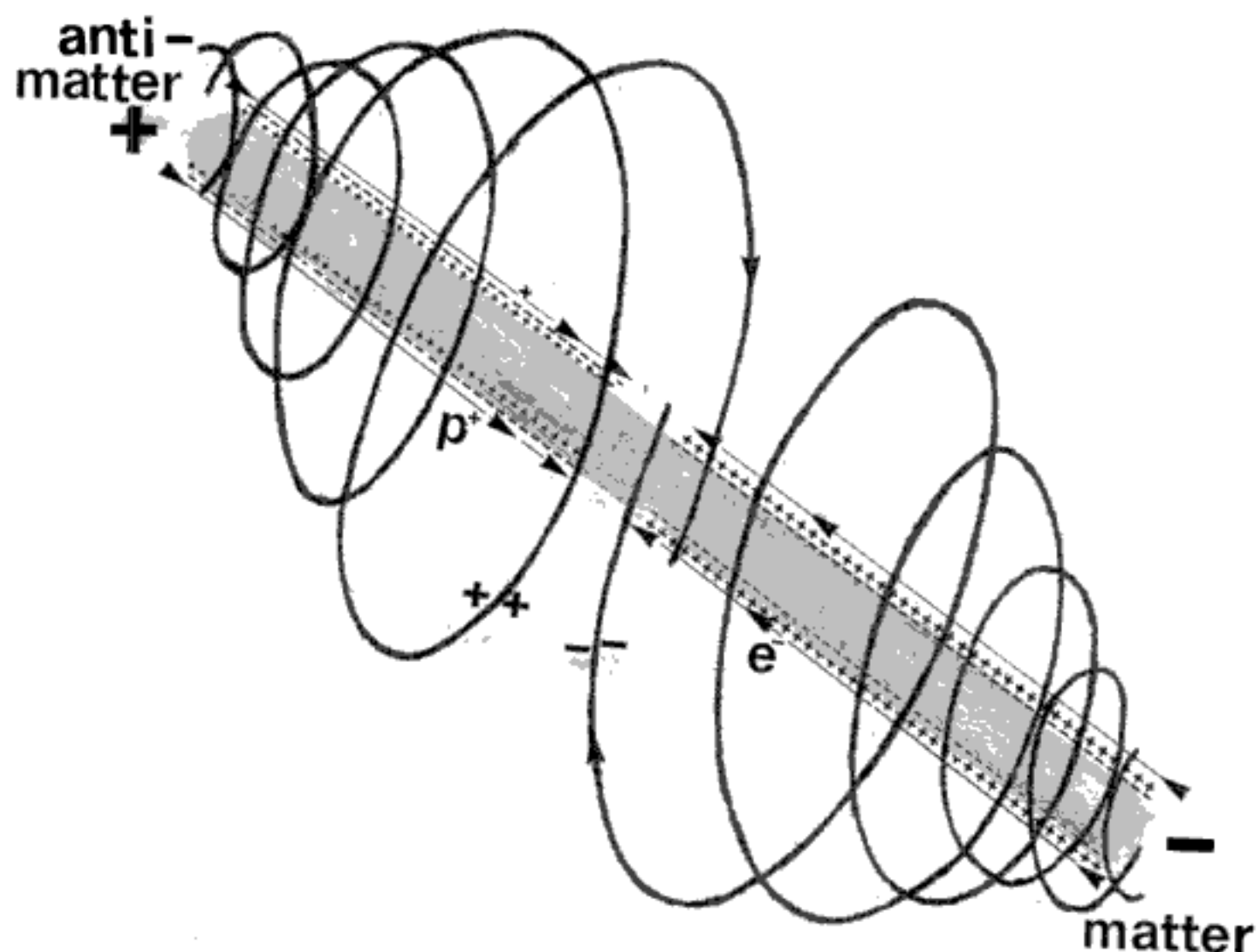


Fig. 42. Inside the vortices a "central core" of structured (gaseous) dielectrics is formed between polarizing matter and antimatter (See also Fig. 19). The circulating vortex-charges induce, gradually, a surface polarization of the anodic and cathodic "core". The whole surface will produce a stepwise "growing" dipole layer (here, only two anodic and two cathodic rows of dipoles are indicated) presenting a selective interphase (super-) conductivity (Fig. 22a). The gradual induction of conductivity of the surface of the core will, sooner or later, lead to internal contact between them leading, to a **giant celestial lightning** with charge-annihilation. The vortex and core-structures will be destroyed, leaving spiralling new matter of the nebula, clouds of remaining positrons (recently discovered) and clouds of electrons to be detected.

thodic parts of the fields will meet, producing quenching. The liberation of co-transported particles should then, by their charges, their molecular concentration forces, gravitation, etc, lead to various new forms of matter within the nebula. Even the very critical and difficult issue of formation and location of planetary water might, in this way, have an explanation. The model experiments for the creation of new forms of matter including water are described and related to Fig. 14, 15, 16, 17 and 23.

The production and location of water on planets is, from a biological standpoint, extremely important since water is the most fundamental matter for the production of biological structures. In an earlier presented con-

cept water might have occurred by a carrier function of meteorites. The presented “electrophoretic theory” is an alternative explanation to this. The vorticizing EMF, sweeping anodic protons and cathodic hydroxyl ions might possibly give an explanation of the large amounts of water in the oceans of the earth.

The earlier postulated mechanism of closed circuit circulation for effective mass transports by the celestial EMF needs an explanation. One focus of electropositive antimatter (positrons) and one of electronegative matter (electrons) are anticipated to induce a bipolar EMF. The inherited tendency of the EMF to circulate under spiralling expansion, and its simultaneous tendency to make co-transport of charged particles, might lead to a collection of various kinds of matter in the spiralling vortex fields. The charged matter in the vortex transport leads to circulating magnetic fields, inducing the structuring of a central core of dielectrics between the polarizing foci. This is similar to what was described in the in vitro model illustrated in Fig. 19. A dielectric central “core” in the vortex can initially only transmit “signals” at variations of the polarizing foci. The movements of the charges carried by the electropositive and electronegative EMF vorteces might induce gradually growing a dipole-layer of the surface of the central core and provide preferential interphase conductivity. (See exp. rel. To Fig. 22.) When the gradual vortex-spiralling has stepwise induced a communicating conductive, dipole-surface layer (Fig. 42) of the **entire central “core”**, an internal “step leader”-contact by the vorteces is established. This should lead to a sudden giant annihilation of positrons and electrons like in a stroke of lightening (See “Lightening” page 61) with field quenching of the anodic and cathodic EMF of the “core” and vorteces. Field transported matter – antimatter may not necessarily lead to total annihilation but result in a new central planet of the nebula with orbital circulation of “satellite” planets formed at the quenching of the spiralling EMF-vorteces. After such a magnificent celestial “orgasm” already proliferated new **condensed matter** of the nebulae may still present **spiralling structures**. Remaining **clouds of positrons and electrons** should also be possible to identify.

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Afterword

To be astonished at anything, is the first movement
of the mind towards discovery.

Claude Bernard

The events leading up to this book began well over four decades ago, when the author became intrigued about the origin and nature of a “halo-like” disturbance that could occasionally be seen around lung malignancies on routine X-rays. It was never present with tumors that were benign. None of his radiological colleagues could offer an explanation for this curious phenomenon, nor did it elicit much interest, let alone astonishment. Most considered it to be an artifact, but Nordenström thought it might represent some sort of energy disturbance that could provide an important clue about the nature of malignancy. He has devoted his life to exploring this ever since in a multidisciplinary approach that has required innovative basic research, animal and clinical investigations.

He published a few papers confirming that the electrical characteristics of lung cancers differed from normal tissue, but there was little response. Undaunted, he continued his research, which eventually led him to the conclusion that the body had an additional communication or circulatory system not previously appreciated. In 1979, he began writing a book entitled *Biologically Closed Electrical Circuits* to explain this. The final product was a large, handsome volume of over 350 pages, replete with elaborate art work, diagrams, x-rays, and reproductions of gross and microscopic pathology, many of which were in color. However, the medical publishing houses were not very interested in this, probably because they thought it would not be profitable, and they were correct. Nordenström had to raise \$50,000 to finally publish it himself in 1983, and of the 2 000 copies printed, only 200 were sold.

There were several reason for this, the main one being that few individuals, had the strong background in mathematics, physics, biochemistry, physiology, pathology, and imaging techniques required to comprehend its contents. The lack of an advertising budget and the price of \$135 needed to defray part of the publishing costs were other deterrents. Those with the

ability or time to wade through this tome may not have agreed with Nordenström's conclusions, but it was impossible not to be impressed with the ingenuity and integrity of his research, and its staggering implications. Judah Folkman, the renowned cancer researcher, described it as having "extraordinary potential", but was preoccupied with pursuing his anti-angiogenesis therapy, which recently attracted international attention, others put the publication on a par with William Harvey's 1628 treatise on the circulation of the blood. As one reviewer commented: "If he is right, he has made the most profound biomedical discovery of the century." The following is an attempt to explain why this new book, which details his subsequent studies and speculations, strongly supports this prophecy.

Good health depends on the ability to maintain all body functions within normal limits whenever this state is threatened by stress or any demand for change. This axiom was first enunciated by the 19th Century physiologist Claude Bernard, who described it as preserving the stability of the *milieu intérieur*. His conception of this "internal environment" was limited to the rudimentary information available at the time about the chemical composition and physical properties of body fluids, cells, tissues, organs, and systems. However, he correctly predicted that "all the vital mechanisms, varied as they are, have only one object: that of preserving constant the conditions of life". Walter Cannon later referred to this as "the steady state", and called the power to maintain it *homeostasis*, from the Greek *homios*, like, similar, and *stasis*, position, status. This precept has subsequently been extended to include all biological systems, ranging from the cell to any form of life in the biosphere.

Cannon's early studies led him to the thesis that when animals were subjected to severe stress, myriad biochemical and physiologic responses were immediately evoked to facilitate life saving "fight or flight" activities. He emphasized the premiere role of stimulation of the sympathetic nervous system and the secretion of what he called "sympathin" in producing these effects. Several decades later, Hans Selye demonstrated that there was a cascade of other hormonal responses involving the hypothalamic-pituitary-axis during acute stress, which he referred to as the "Alarm Reaction". Since then, it has become apparent that various neurotransmitters play an important role in the response to stress, and advances in psychoneuroimmunology show that the immune system is also involved. All of these neurohumoral, endocrine, immune and nervous system reactions

have been exquisitely honed over millions of years of evolution to preserve life and health by acting in concert with one another, much like individual instruments in an orchestra. Constant feedback is required to signal any change in status so that appropriate alterations can continually be made. This could not occur without some incredible system of communication with the capability of ceaselessly monitoring and responding effectively to continuing changes within milliseconds.

But how can this be accomplished? How does communication take place in the body? The role of the central nervous system is fairly well delineated, with its autonomic sympathetic and parasympathetic components that are antagonistic but complementary. The endocrine system has its own balancing mechanisms, in which the secretion of hormones is regulated by feedback from target glands or metabolic consequence. Much less is known about how equilibrium is maintained in neurotransmitter networks, or the immune system, which has both hardwired and humoral connections to central nervous system structures. Our current concept of communication is at a chemical/molecular level that is based on Newtonian physics and laws of thermodynamics that do not explain how feeble electromagnetic forces can produce powerful psychophysiologic effects, or what governs the continual flux of different ions across cell membranes. The speed, versatility, and integration of all these activities suggests the existence of the biologic equivalent of electrical systems composed of electrodes, switches, amplifiers, resistors, and capacitors, that can store and regulate energy flow. Björn Nordenström has referred to these as “biologically closed electrical circuits” (BCEC), and in his previous book, concentrated on the “Vascular-Interstitial Closed Circuit” (VICC). In this offering, he demonstrates that there are numerous circuits ranging in size from meters to microns, that utilize both ionic and electronic electricity, and produce electromagnetic fields with varying frequencies, amplitudes, and wave lengths. He further explains how an understanding of this can enable us to treat cancer and possibly other disorders due to disturbances in electrical homeostasis.

Is there any evidence to support such a concept of energy equilibrium? Life on earth evolved under constant geomagnetic influences, so it should not be surprising that all living cells, tissues, and organs are sensitive “electromagnetic systems” with specific electrical or magnetic resonance characteristics. Robert Becker has shown that our bodies exhibit a positive

polarity along the central axis, and a negative polarity in peripheral structures. He has also demonstrated that this polarity is reversed in hypnosis and anesthesia, as well as following an injury which creates a positive potential at the site of trauma. Becker believes that this reversal of polarity generates a micro current of injury which is conducted through Schwann and glial cell sheaths surrounding neurons, that act to initiate repair and regenerative processes. Nordenström has proposed that there is a local build-up of positively charged ions following injury that creates an electrical voltage potential between opposite ions that are separated. Much as occurs in a battery, this energy can be tapped once circuit is closed to permit the flow of electricity between these charged areas. When a disorder is diagnosed as being due to some chemical deficiency or imbalance, we administer appropriate supplements or drugs to rectify the problem. But we can also detect disease through abnormalities in the electrocardiogram, electroencephalogram and myogram, or with magnetic resonance imaging, magnetoencephalography, and magnetocardiography. Therefore, why should it not be possible to restore health by correcting electrical or electromagnetic energy disturbances, which, in the final analysis, is probably how all other therapies eventually work? If an electrocardiogram reveals a bundle branch block or ischemia, or EEG waves are abnormal, can electromagnetic energies that correct such aberrations improve the patient's clinical status? This has already been demonstrated for certain types of epilepsy. Cranioelectrical stimulation approaches can also induce alpha theta patterns similar to those achieved by accomplished meditators, and provide a similar state of deep relaxation. Do brain and heart BCEC's influence one another? About 1 in 1000 patients with epilepsy dies suddenly and unexpectedly with no obvious medical cause. A recent study comparing the hearts of epileptics who died unexpectedly with healthy controls who had died by hanging or drug overdose suggests such a link. No pathology was found in the latter group, but irreversible perivascular and interstitial fibrosis was present in 5 of the 7 patients with epilepsy.

Nordenström has proven how specific DC microcurrents that restore ion electricity balance can be utilized to treat cancer. Others have shown that electrical energy approaches can also alleviate pain and promote healing. Electromagnetic therapy is now well established as a safe and effective treatment for fractures that have failed to unite normally, and has been successful in several hundred thousand patients, including some in whom

there had been non-union for fifteen or more years. The FDA has more recently allowed claims of efficacy for weak cranioelectrical stimulation in the treatment of anxiety, depression and insomnia. Repetitive transcranial magnetic stimulation (rTMS) directed to a specific area in the frontal cortex showing disturbed energy patterns in depressed patients, can restore this to normal while relieving their symptoms, which had failed to respond to antidepressant drugs. Electrical or electromagnetic stimulation has been shown to reduce pain and accelerate the healing of traumatic soft tissue and bone injuries, prevent osteoporosis, reverse metastatic bone disease and end stage cardiomyopathy, improve glaucoma and senile macular degeneration, relieve arthritic pain and disability, and to provide significant benefits for patients with Parkinson's Disease, multiple sclerosis, epilepsy, substance abuse, alcoholism, and drug withdrawal symptoms. Double blind studies confirm that even static magnetic fields can relieve the pain of post-polio syndrome and fibromyalgia, and clinical trials suggest they may be effective in diabetic neuropathy, osteoarthritis and carpal tunnel syndrome, and they can also speed up the healing of soft tissue injuries and fractures, and reduce post-operative ecchymoses and inflammation.

How could such an astoundingly array of benefits be achieved for different disorders with no common cause or clinical characteristics? Since these also respond to very different drugs or other interventions, how can one account for the efficacy of electrotherapy in all, especially when its mechanism of action in any is not clear? One way to explain this is that the first sign of cellular injury is a reduction in its content of adenosine triphosphate (ATP), whose powerful phosphate bonds are its sole source of energy. As each phosphate group is removed, the bond that connects it to the rest of the molecule releases energy that can be used for growth, reproduction, muscle contraction, or any other activity. The difference between a cell that is alive and healthy and one that is dead or dying, is essentially the amount of ATP energy it can utilize for any purpose it chooses, just as electricity can be harnessed to provide light, sound, motion, heat, or cold. One study showed that a current of 500 micro-amperes can raise ATP levels almost 500%, as judged by increased protein synthesis and intracellular influx of calcium. In another study of excised tendon tissue, seven micro-amperes produced a 255% increase in hydroxyproline uptake, with microscopic confirmation of accelerated tissue repair and regeneration. The ability of microstimulation to boost ATP and influence ionic flux in muscle,

nerve, brain, pancreatic and other cells could explain such variegated rewards, since the manifestations of ATP deficiency would be different for each of these. Demetrio Sodi-Pallares, who described the sodium/potassium pump mechanism in cells and its important role in ATP synthesis, showed decades ago that damage due to myocardial infarction could be reduced by administering a polarizing solution that tended to restore the normal differential that existed between the intracellular and extracellular concentrations of these ions. He has now convincingly demonstrated that electromagnetic stimulation can reverse metastatic malignancy and end stage cardiomyopathy in terminally ill patients, when it is combined with polarizing solution and nutritional interventions that also increase ATP.

We can readily appreciate ATP synthesis at a chemical/molecular level, which is how we presently view most reactions and communicative processes in the body. It is easy to visualize small peptide messengers fitting into specialized receptor sites, and scientists have increasingly tried to explain how mood, behavior, cravings, and responses to stress are mediated by neurotransmitters like serotonin, dopamine, nor-epinephrine, and the endorphins. Various clinical states seem to correlate with their levels, or the availability of locks they can open by chemical rather than physical means. However, in the final analysis, all these messages are transmitted by means of infinitesimally weak energy transfers that occur at an atomic level. It is increasingly apparent that the cell wall is more than a protective shield studded with receptor sites for molecules like antibodies and small neuropeptides. Rather, it is emerging as a powerful signal amplifier that provides an interactive window through which the cell senses and responds to its environment. Some substances can pass freely back and forth through specified channels, but for others, it is an impenetrable barrier. A 1991 Nobel Prize was awarded to Erwin Neher and Bert Sakmann for demonstrating that cell walls contain "voltage dependent" channels that are selective for different ions. When activated by a specific neurotransmitter, a sudden change in electrical potential between the exterior and interior of the cell allows a new channel to open for a few thousandths of a second, during which millions of ions can pass back and forth. Their innovative patch clamp technique made it possible to detect electrical currents of a trillionth of an ampere.

Could cell membranes have receptor sites for such weak signals that produce the same effect as molecules? Electrical stimulation of highly spe-

cific sites in the pain pathway produces analgesia, as does microinjection of morphine at these same locations. Combining amounts of morphine or electrical stimulation that alone are too weak to reduce pain has a synergistic effect that does provide analgesia. This implies that the mechanisms responsible are identical, and that chemical stimulation results in an electrical signal to achieve its ultimate effect. The specific locations that permit pain relief by either modality are the precise sites that natural endorphins bind to, and stimulation a few millimeters away has no effect. Such specific sensitivity to microcurrent stimuli could also account for a variety of putative associations, such as malignancy and proximity to high power lines, birth defects following the use of electric blankets during pregnancy, and psychophysiologic changes due to geomagnetic influences.

In addition to such artificial ambient stimuli, there may also be responses to similar weak energies generated internally. EEG waves may not simply reflect the noise of the machinery of the brain, but rather signals being sent to specialized sites in the body. Such a paradigm could help to elucidate a variety of unexplained mind/body phenomena, such as placebo and nocebo effects, and the spontaneous remission of cancer and other salubrious rewards reported in individuals with a firm faith. The basic defect in the cancer cell is that its growth cannot be controlled, because it fails to communicate normally with its healthy neighbors. Is it possible that having a strong faith or belief generates a feeling of control, and that somehow this message filters down to cancer cells through BCEC or other pathways yet to be delineated? Conversely, the links between stress, depression and cancer have increasingly been forged. The conventional explanation for this chain is that stress causes a weakening of immune system defenses against cancer. But what does that really mean? Scientists can't define stress, because it is a subjective state that differs for each of us. And nobody really knows exactly what the immune system consists of, or where it is located. We try to manipulate the immune system with chemotherapy, or radiation, but both of these, as well as the hormones we use to treat some cancers, can all cause or worsen others. Although stress can't be defined, all of our clinical and laboratory research confirms that the sense or feeling of being out of control is always distressful. How that translates into malignant growth is more likely to eventually be explained by ionic electricity disturbances, rather than our current appreciation of mind/body relationships, which is mired at a chemical/molecular level.

How does any of the above relate to the BCEC concept and this book? It has been assumed that all of the observable phenomena in the cosmos, including biological reactions, can be explained in terms of four fundamental forces, gravity, electromagnetic energy, the weak nuclear force, and the strong nuclear force. However, it is clear that thousands of years ago, a well developed system of medicine existed based on the premise that health depended on the circulation throughout the body of another vital energy called *chi* (*Qi*) through prescribed pathways. Illness resulted when the normal flow of *chi* was blocked. Our oldest written medical text, *The Yellow Emperor's Canon of Internal Medicine*, which dates back to 2000 B.C., explains how such imbalances could be corrected by inserting needles (acupuncture), or applying heat (moxibustion) or lodestones (magnetic fields), at specific sites where these pathways (meridians) were close to the skin.

Health was also impaired if the level of *chi* was deficient, or there was a disturbance in the balance of its complementary components *yin* and *yang*. But where did *chi* come from? Largely from foods, and especially certain herbs, but it was also pervasive in all of nature, including the air we breathe. While Western medicine has generally disregarded or scoffed at such notions, in recent years, the therapeutic benefits of acupuncture, magnetic field and herbal therapies have been increasingly verified and accepted. Acupuncture points that have been known since antiquity, have now been shown to have electrical characteristics different from surrounding skin areas. These electrical properties can be influenced by mental processes, and force fields emanating from healers can be readily visualized using Kirlian and even conventional photography. The energy emanating from *chi gong* masters has been shown to produce physical and chemical changes, and to exert the same influence on ATP synthesis as a magnetic field. The ability of certain well established healers to produce voltage surges of 100 volts and more in recipients several feet away has been well established in scientific studies.

Dynamic forces analogous to *chi* have resurfaced over the centuries as *prana* in Ayurvedic teachings, Paracelsus' *archaeus*, Newton's cosmic aether, Mesmer's "universal fluid" and "animal magnetism", the Odic force of Reichenback, Brunler's biocosmic energy, Reich's orgone, and the energy associated with faith and spiritual healing, or therapeutic touch. Thus, it is not inconceivable that there is a fifth type of energy that may be

utilized to promote health, about which little is known. Nordenström suggests that the forces flowing in BCEC's may be thought of as *chi*, with positive and negative charges that are comparable to *yin* and *yang*. However, it is important to recognize that theories don't have to be correct, only facts do. Some theories are valuable because of their heuristic merit, in that they stimulate others to discover new facts that eventually lead to improved theories. And the facts are that Nordenström's treatment of cancer based on his theories does work, and has now been replicated by others in thousands of patients. There is also little doubt that his concepts have excited others to further explore other clinical ramifications. For example, his investigations suggested the presence of a BCEC between the mouth and the nose to explain the benefits of zinc ion therapy for colds, and this now appears to have been demonstrated. A semiconductor material made from a tightly woven, high density polymer charged with electrons can store this energy for years, much like a capacitor. When brought into contact with skin, it creates a closed circuit which delivers a sustained negative current of micro-amperes at a frequency of 6–8 Hertz for up to 48 hours that counteracts the build up of positive ions that Nordenström has demonstrated occurs in injured tissue. It has been used successfully to relieve discomfort and swelling following trauma, and in a variety of pain syndromes. It allegedly speeds up the healing process by increasing ATP, intracellular calcium uptake, amino acid transport, and protein synthesis. Another application has been the use of brief microcurrent stimulation to cause transient openings in the cell membrane, a process known as electroporation. This makes it possible for chemotherapeutic agents like bleomycin to reach lethal concentrations in malignant cells that would otherwise not be possible. Electroporation has been used with success to treat patients with head and neck, pancreas and liver cancer, as well as Kaposi's sarcoma and malignant melanoma. Cloning is also not possible unless a minute electrical impulse is applied to an unfertilized ovum to make it fuse with a donor cell. Successive electrical pulses are then required for it to accept the new nucleus as its own, and again to trigger biochemical activities that jump start the process of cell division and growth. Electricity is literally, as well as figuratively, "the spark of life".

The BCEC concept has given rise to picotesla stimulation approaches for the treatment of Parkinson's disease, epilepsy, multiple sclerosis and other neurodegenerative disorders with promising results. This is not to imply

that Nordenström necessarily endorses or is familiar with all of the above. He may not even be aware of many others that are not as scientifically sound, but similarly cite his work to gain some patina of legitimacy and authority. And there are other caveats to be aware of in this burgeoning field of bioelectromagnetics. Having had the good fortune to collaborate with Hans Selye during his early attempts to explain his stress concept, as well as Flanders Dunbar, who introduced the term psychosomatic into American medicine, I am well aware of the negative reaction and at times derision they were greeted with by the scientific community. Björn Nordenström has escaped much of this because his credentials and research are impeccable. He has served as Chairman of the Department of Radiology at Karolinska Institute, and President of the Nobel Assembly that selects the Nobel Laureate for Physiology or Medicine, and also pioneered balloon catheterization and needle biopsy techniques. However, as his theory and various therapies based on this are increasingly shown to have merit, there will be undoubtedly be numerous imitations by entrepreneurs and charlatans, with worthless wares and services that claim to provide the same benefits. This will be a particular problem in patients with cancer who have failed to respond to conventional treatment, and are desperately searching for some authentic alternative therapy. It is likely that legitimate efforts will be drowned out by copycat approaches claiming to be based on Nordenström's concepts that will not work, or could conceivably be harmful, if proven conventional therapies are bypassed. As a result, there is the very real danger that his treatment program may fall into disrepute, and that the baby will be thrown out with the bathwater. From a practical standpoint, it is also important to recognize that cancer therapy is a multibillion dollar industry. Powerful vested interests could also impede progress if they are threatened by a proliferation of electromedical devices and therapies that affect their bottom line. There is good reason to suspect that this confrontation is not far off, since much of the following prophecy has already come true.

In the decade to come, it is safe to predict, bioelectromagnetics will assume a therapeutic importance equal to, or greater than, that of pharmacology and surgery today. With proper interdisciplinary effort, significant inroads can be made in controlling the ravages of cancer, some forms of heart disease, arthritis, hormonal disorders, and neurological scourges such as Alzheimer's disease, spinal cord injury, and multiple sclerosis. This prediction is not pie-in the sky. Pilot studies and biological mechanisms already described in primordial terms, form a rational basis for such a statement.

J. Andrew L. Basset, 1992

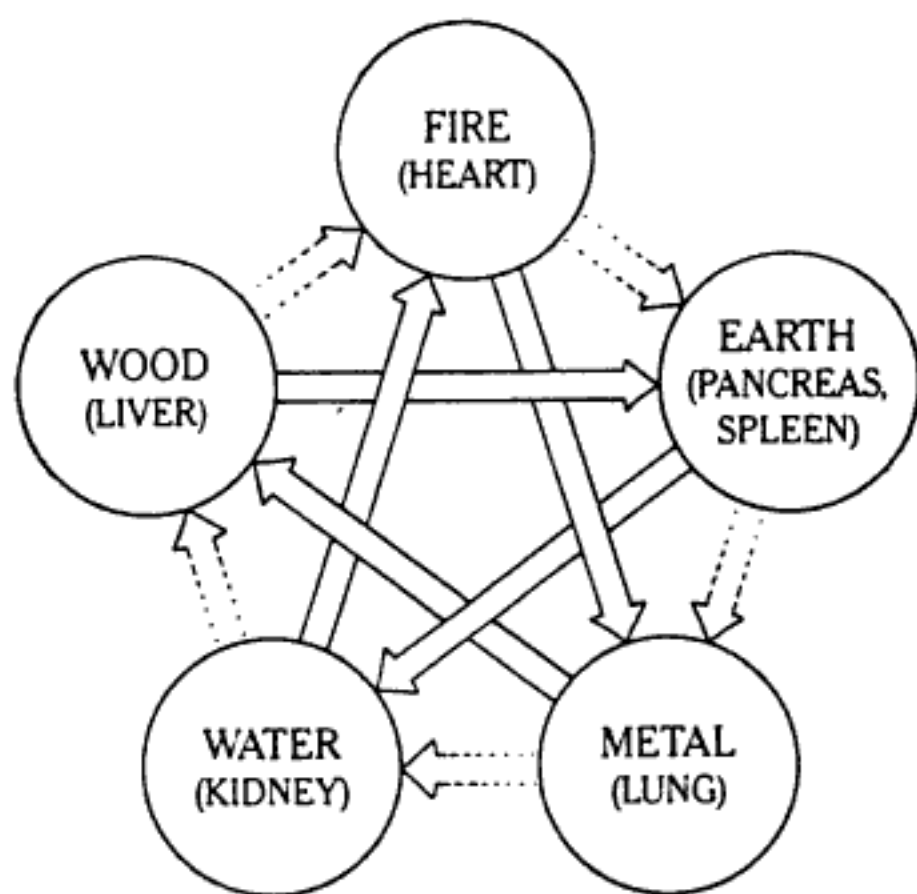
Do electromagnetic forces have the potential for harm? Such concerns have been raised about the possible relationships between high power line and cellular telephone emanations and various malignancies. Ambient electromagnetic influences remained fairly constant on earth up until only 100 years ago, when Thomas Edison built the first electrical generating station in New York. Since then, the atmosphere has been progressively polluted with all sorts of energy signals. Whether such potential stimuli have long term psychophysiologic effects remains to be determined, and some suggest that damaging information has been suppressed by powerful interests because of disastrous financial consequences.

In *The Structure of Scientific Revolution*, Thomas Kuhn asks “Does a field make progress because it is a science, or is it a science because it makes progress?” Up until recently, biomagnetics has been much more of a disorganized field, with therapies based primarily on empiric results and subjective speculations. It is now steadily assuming the status of a science, with the potential for rapid progress. Ross Adey’s seminal research has demonstrated that the biological effects of electromagnetic fields do not necessarily follow dose-response relationships or laws of thermodynamics. He has described a selective “window” below the level of thermal noise, and nonthermal effects have been confirmed by others. Low emission energy therapy in the range of CB radio transmission has been shown in double blind polysomnography studies at major University sleep centers to be a safe and effective treatment for insomnia that is superior to hypnotics, and devoid of their side effects and addictive tendencies. Picotesla stimulation based on Jacobson resonance formulations is also on the fast track for FDA approval for treatment of pain, and has been demonstrated to significantly accelerate nerve growth and repair. Clinical results suggest that it may be effective in Parkinson’s disease, multiple sclerosis, epilepsy, and other neurologic disorders.

Björn Nordenström has played a propadeutic role in transforming electrotherapy and biomagnetics into a science, but his vision and contributions extend far beyond medicine. In this remarkable book, he has dramatically expanded BCEC pathways in the body, to provide a panoramic perspective of how these networks can communicate with the external environment. This ranges from explaining how the tail of a cat acts as an antenna to detect danger and animals keep their fur clean, to the origins of life, and the universe. Just as a cat’s tail acts as an antenna, there is good

reason to suspect that the thousands of acupuncture points in the body function in a similar fashion, much like a sophisticated radar system. There is little doubt that some dowzers are extremely sensitive to weak geomagnetic forces that activate acupuncture points to produce muscular activity. The Oriental concept of *Feng Shui* is based on the belief that our health and behavior can be affected by the size, shape, color, and configuration of objects, as well as subtle light, sound, and geomagnetic forces. Some people believe that the axis of the body in relation to the magnetic poles while sleeping is important, or that they can sense the thoughts and feelings of others. And we do constantly transmit subtle signals, or “vibes”, as well as receive them. Weak electromagnetic fields that influence ion resonance are now being used to improve the size and yield of crops by commercial growers of plants and flowers. Harold Saxton Burr and others have also convincingly demonstrated that human thoughts and emotions can affect the growth and health of plants, and certain individuals really do seem to have a “green thumb”. The electrical resistance between two acupuncture points differs by a factor of 20 from two points the same distance apart in normal skin. This resistance is significantly altered during sleep, hypnosis, and excitement. How this is accomplished is not clear, but could involve infinitesimally weak energies transmitted through BCEC’s. It does not seem unreasonable to assume that similar subtle signals from the external environment could also be detected and produce psychophysiologic responses.

There are other analogies with ancient Oriental concepts of how the *chi* in Nature can affect human health, performance, and possibly aging. Life-span varies greatly in animals, plants, and even different tissues in humans. It is believed that the life of a cell is genetically predetermined by limiting the number of times it can divide and reproduce. This process of programmed cell death, called apoptosis, is specific for each cell. Nordenström has described how biomagnetic forces can influence either regression (apoptosis) or proliferation (regrowth and survival) by explaining how a tree preserves its life during the cold winter by altering metabolic activities to sacrifice its leaves in the fall. He illustrates how even a leaf that is “dead”, still has energy in the form of a corona around it that can be seen with Kirlian photography. In the spring, apoptotic regression is replaced by proliferative regeneration, when energy preserved in the tree is activated by heat to again produce the same kind of leaf. This repetitive



The five elements and their relationship to energy flow between the internal organs.

cycle of death and rebirth that can be guided by the same energy constantly takes place in other systems, and are interrelated to provide balance in the Chinese view of Nature. One example is provided by the *Sheng* and *Ke* cycles of ongoing regeneration and destruction for the five elements and their associated organs, a portion of which is depicted above.

The outer pentagonal pattern on the right with dotted arrows shows a cycle of Regeneration – fire produces earth by burning wood into ash which replenishes earth. Earth contains metallic ores which were believed to produce water, since the source of mountain springs was frequently found near such rich deposits. Water produces wood because trees grow by absorbing water through their roots. Wood produces fire, and the cycle begins again.

The inner pattern of solid arrows is one of Destruction – wood roots break up the earth, earthen dams block the flow of water, water extinguishes fire, and fire can melt metal. A Metal ax destroys wood, and the cycle starts over.

In Chinese medicine, the individual is a microcosm in harmony with the macrocosm of nature, which has an underlying order that unites all its components. Organs that correspond with elements mirror their energy flow and relationships. The heart (fire) supports the spleen (earth) which in turn energizes the lungs (metal). From the lungs, the flow of energy is to the kidneys (water), where it is transmitted via meridians to the liver (wood), and then back to the heart where the cycle begins again. If the *chi*

in an organ is not balanced, this orderly energy flow stops, and the next organ in the inner pattern of destruction can become disturbed. Thus, if the heart *chi* is unbalanced, it affects the lungs, then the liver, and eventually the kidneys. (This sequence actually does occur in congestive failure.)

“And there is no new thing under the sun.” the Bible warns in *Ecclesiastes*. Are the forces or energies in magnetic fields, as well as those involved in faith healing, therapeutic touch, consciousness, intentionality, and BCEC’s the same, or some manifestation of *chi*? Albert Einstein also believed that there was an underlying order to the organization and operation of the Universe based on mathematical principles. He proposed not only that electromagnetism and gravity were different aspects of the same force, but that all the four forms of energy were interrelated, and scientists have been trying to prove this Unified Field Theory ever since. Is *chi* a fifth form of energy that will prove to be the glue that binds all of the others together? The Chinese sage Lao Tsu described *chi* as follows:

Look, it cannot be seen – it is beyond form.

Listen, it cannot be heard – it is beyond sound.

Grasp, it cannot be held – it is intangible.

Is the human mind capable of comprehending *chi*, or, like infinity, and the lack of distinction between energy and matter at subatomic levels, is it impossible for us to visualize its composition and mechanism of communication?

As emphasized previously, good health is dependent on good communication – good communication within the internal environment and with the external milieu. This applies to the entire hierarchy of living systems, ranging upward from cells, tissues, organs, and people, to families, corporations and societies. Good health depends not only on good communication within each of these units, but also all of those above and below it. Disturbances in any one reverberates up and down the line, and some unifying force like *chi* could provide a clue as to how this communication takes place. Björn Nordenström has suggested that the energy in his biologically closed electrical circulatory systems may be thought of as *chi*, and has shown us how some cancers can be cured. He may have also opened the door to a greater understanding of how we can communicate with other living systems to improve health and harmony in Nature, and is the epitome of the true scientist, as described below by Jules Henri Poincaré.

The scientist does not study nature because it is useful; he studies it because he delights in it, and he delights in it because it is beautiful. If it were not beautiful, it would not be worth knowing, and if nature were not worth knowing, life would not be worth living."

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